United Nations
Interregional Crime and Justice
Research Institute

ILLICIT PESTICIDES, ORGANIZED CRIME AND SUPPLY CHAIN INTEGRITY

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PREFACE

Crime prevention and criminal justice issues affect all aspects of development, including its economic, social and environmental dimensions, as well as its sustainability. In the United Nations Salvador Declaration of April 2010, Member States underlined the necessity to strengthen national crime prevention and criminal justice systems, policies and practices in combating emerging forms of crime, such as those having a significant impact on the environment, and other related serious crimes.

The United Nations Interregional Crime and Justice Research Institute (UNICRI) considers environmental crime and its links with other serious crimes a clear and serious threat for sustainable development, global stability and security. Since 1991, the Institute has dealt with crimes against the environment and related emerging threats through applied research, awareness, and capacity-building initiatives.

In its Resolution 2012/19 entitled "Strengthening international cooperation in combating transnational organized crime in all its forms and manifestations", the Economic and Social Council "Invites the United Nations Interregional Crime and Justice Research Institute […] to continue to conduct, in consultation with Member States and in cooperation with other competent international entities, research on different forms of transnational organized crime", including crimes against the environment. In addition in 2013, in the European Parliament Report (2012/2117(INI)) "on organized crime, corruption and money laundering: recommendations on action and initiatives", explicit reference is made to the work of the Institute in this field, as recommendation 51 states: "The European Parliament [...] recommends joint action to prevent and combat illegal environment-related activities connected to or resulting from organized mafia-style criminal activities, also by strengthening European bodies, such as Europol and Eurojust, and international ones, such as Interpol and UNICRI [...]."

In this framework, UNICRI is developing a programme aimed at enhancing an international strategy to counter serious and organized groups involved in crimes having an adverse impact on the environment, including in the trafficking of illicit pesticides. Illicit pesticides represent a lucrative activity for organized crime and a concrete threat to security, development, health and the environment, and consequently require urgent response from the national and regional authorities, as well as the international community and the United Nations.

The present research paper aims at deepening the general knowledge on current trends related to illicit pesticides, identifying the actors and organized crime groups (OCGs) and networks involvement and their modus operandi, and understanding the supply chain vulnerabilities.

The findings of this research paper have been discussed during an Expert Workshop with the objective of identifying good practices for detecting, investigating and prosecuting illicit pesticides related activities and, ultimately, improving capacities in countering illicit pesticides. Inputs and outcomes formulated during and after the meeting have been included in the present paper.

The ultimate results of this analysis are to design a roadmap for actions outlining the follow-up activities to be implemented, to disseminate best practices, to reinforce dialogue and cooperation among stakeholders, and to enhance national and international capabilities to combat international illicit trafficking of pesticides.

Cindy J. Smith, Ph.D., Director

OVERVIEW

This policy paper is divided into four sections. The first presents an overview of the risks and impacts of illicit pesticide use on human health, livestock and food supplies, the environment, and the international agricultural trade.

The second section presents data and information on actors and agents, modus operandi, observed trends, product flows and a regional profiles of the pesticides market. This section also considers trade, agricultural and food supply chain characteristics, security vulnerabilities, and protection and defense measures against organized crime groups and networks that have infiltrated international agro-chemicals and pesticide markets.

The third section summarizes key regulatory issues, identifies obstacles and indicates concrete actions to prevent and combat the importation, sale and use of illicit pesticides, as well as the role of the actors involved in the control and securitization of the market.

The final section concludes with the role of UNICRI in addressing the issues of illicit pesticides, in particular in facilitating research, raising stakeholders' awareness, delivering training and technical assistance programmes, supporting in capacity building activities and reinforcing national and international cooperation.

LIST OF ABBREVIATIONS AND ACRONYMS

API	Active Pharmaceutical Ingredient, also referred to as AI, active ingredient
BASCAP	Business Action to Stop Counterfeiting and Piracy
BKA	Bundeskriminalamt
CARIN	Camden Asset Recovery Inter-Agency Network
CDPR	California Department of Pesticide Registration
Cefic	European Chemical Industry Council
CIPAC	Collaborative International Pesticides Analytical Council
CSR	Corporate Social Responsibility
ECPA	European Crop Protection Association
EECCA	Eastern Europe, Caucasus and Central Asia
EFCG	European Fine Chemicals Group
ENPE	European Network of Prosecutors for the Environment
EPA	Environmental Protection Agency
EU	European Union
EUFJE	European Union Forum of Judges for the Environment
Eurojust	European Union Judicial Cooperation Unit
Europol	European Police Agency
FAO	Food and Agriculture Organization of the United Nations
FATF	Financial Action Task Force
FCL	Full-container load
FDA	Food and Drug Administration
FF	Freight forwarder
FICCI	Federation of Indian Chamber of Commerce and Industry
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FTZ	Free Trade Zone
FVO	Food and Veterinary Office
GAGER	German Advisory Group on Economic Reform
GAP	Good Agricultural Practices
GHS	Globally Harmonized System
GMP	Good Manufacturing Practices
HHP	Highly Hazardous Pesticide

IAP	International Association of Prosecutors
ICAMA	Institute for the Control of Agrochemicals, Ministry of Agriculture, China
ICC	International Chamber of Commerce
IERPC	Institute for Economic Research and Policy Consulting
ILO	International Labour Organization
IOMC	Inter-Organization Programme for the Sound Management of Chemicals
IPM	Integrated Pest Management
IPR	Intellectual Property Rights
IVM	Integrated Vector Management
KYC	Know Your Customer
KYS	Know Your Supplier
LCL	Less-than-container load
LEA	Law Enforcement Agencies
MRL	Maximum Residue Levels
n.a.	Not applicable
n.d.	No date
NGO	Non-Governmental Organization
NPIC	National Pesticide Information Center
NVOCC	Non-Vessel Owning Common Carrier
OCG	Organized Crime Group
OECD	Organization for Economic Co-operation and Development
OHIM	Office for Harmonization in the Internal Market
OLAF	European Anti-Fraud Office
PMRA	Pest Management Regulatory Agency
POP	Persistent Organic Pollutant
PPP	Plant Protection Products
RASFF	Rapid Alert System for Food and Feed
ROAP	Regional Office for Asia and the Pacific
SAICM	Strategic Approach to International Chemicals Management
SSFFC	Substandard, spurious, falsely-labeled, falsified, counterfeit
UK	United Kingdom
UNCETDG	United Nations Committee of Experts on the Transport of Dangerous Goods and Labeling of Chemicals

UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNICRI	United Nations Interregional Crime and Justice Research Institute
UNITAR	United Nations Institute for Training and Research
US	United States of America
USD	United States Dollar
USDA	United States Department of Agriculture
VPA	Voluntary Partnership Agreement
WCO	World Customs Organization
WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Scheme

List of Tables and Graphics

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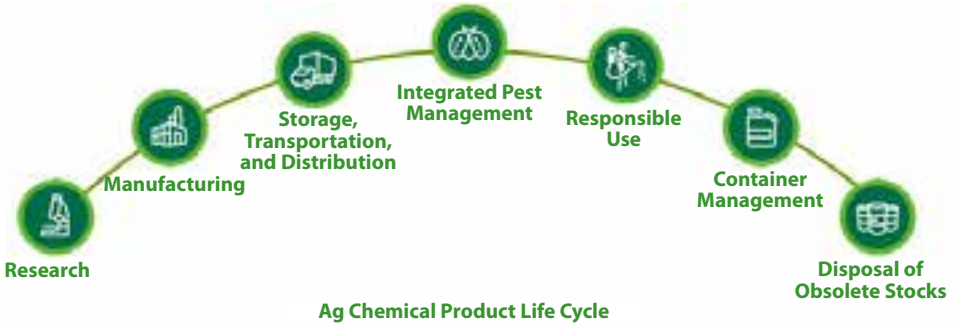
THE PROBLEM OF ILLICIT PESTICIDES

For more than a decade, regulators, industry and farmers in numerous countries have been struggling with the growing market in illicit agro-chemicals and illicit plant protection products[1] (PPPs). In 2007, the Organization for Economic Co-operation and Development (OECD) estimated that 5-7% of the global market for pesticides involved counterfeit products; by 2011, it had raised that estimate to 10% (Guyer and Davreux, 2012). Worldwide estimates of trade in illegal and counterfeit markets range from 5-15% for most types of products and commodities (ECPA, 2006; Guyer and Davreux, 2012). DG-SANTE indicates that about 10% of the European Union (EU) pesticides market is comprised of illegal pesticides, noting significant variation between Member States (European Commission, 2015). Other sources have indicated that more than 25% of pesticide products in some EU Member States are counterfeit (ECPA, 2008). Illicit pesticides pose potentially serious threats to human safety and health, economies, businesses and farmers, the environment, and national security.

Legal agro-chemicals and pesticides present safety challenges and health hazards throughout their product cycles (from development to final disposal) with the most severe potential adverse consequences occurring during the storage, transportation and distribution, use and disposal stages. *Graphic 1* presents the pesticide life cycle. Responsible use and disposal of pesticides are an especially important aspect of pesticide safety, human and environmental health. Illicit pesticides further compound inherent pesticide risks through the introduction of mislabeled, unregulated, and unidentified substances to workers and consumers, and into food crops and broader ecosystems.



Graphic 1.
Pesticide (agro-chemical) life cycle

Source:
Dow Agro Chemical

Expanding global markets generate new and abundant opportunities for illicit goods in food, pharmaceutical, manufacturing, and technology sectors. One especially important sector of growth in illicit markets is agricultural and food products for which provenance, authenticity, and safety may be fundamentally more difficult for authorities and consumers to track and assess than for more durable goods. Growth of global agricultural markets has been accompanied by a corresponding rise in illicit chemical and plant protection products related to

1. The term plant protection products refers to chemical and biological products designed to influence and preserve the life processes of plants and to destroy or prevent the impacts of insects, fungi, undesired plants and undesirable plant growth.

agricultural inputs, food crops, and processed foods.

As early as 2001, the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) estimated that around 30% of pesticides marketed in developing countries, with an estimated value of USD 900 million annually, did not meet internationally accepted quality standards (WHO, 2001). While not all quality failures can be considered evidence of deliberate fraud, the use of banned, obsolete, unregistered, and repackaged pesticides pose arguably more severe potential health threats to users and crop consumers than legal, regulated pesticides. Inhalation, skin exposure, ingestion and accumulation of identified toxins above acceptable levels (maximum residue levels or MRLs[2]) are the primary sources of harmful human health exposures.

All illicit products present a host of challenges to enforcement of trade regulations and controls (including taxation avoidance), industrial regulation and operations, farming operations, and consumer behavior and safety. Illicit goods also raise fundamental questions about legal and economic responsibility, social harm, and how illicit products and precursors are insinuated into legitimate distribution and supply chains. As mentioned, deleterious impacts of illicit pesticides are numerous and include damage to human and animal health, agricultural production, economic development and trade, water supplies and natural resources, including wildlife and indigenous plants. *Table 1* highlights major potential hazards and risks at each stage in the pesticide life cycle.

2. Maximum residue levels (MRLs) are the upper legal levels of concentration of pesticide residues in food or feed. These levels or limits are indicators of the correct usage of authorized, legal pesticides and insure compliance with applicable national legal requirements regarding pesticides.

Pesticide Life Cycle Stage	Potential Source of Harm
Research	• Hazardous chemical handling exposure • Product damage to environment during field testing • Product harm to plants and animals during product testing
Manufacturing	• Product contamination from manufacture on shared equipment • Mis-labeling • Willful product modification for economic gain (including substitution for active ingredients or with less expensive ingredients) • Unknowingly using contaminated raw materials • Inadequate Quality Assurance or Quality Compliance control measures • Lack of registrant oversight of hired/contract manufacturer • Mis-assessment or misidentification of identity, purity and potency of product • Lack of validated analytical methods and reference materials of unknown purity and/or stability • Mis-handled samples • Lack of staff training
Storage	• Deliberate disregard of storage requirements • Unlocked storage facilities • Improvised storage areas • Leaking or damaged containers • Damage or lost labels • Catastrophic failure or fire • Environmental contamination or damage • Lack of separation of different pesticides in storage (e.g., intended purpose, flammability, combustibility, corrosivity)

Table 1.
Potential sources of harm from illicit pesticides, by pesticide life cycle stage

Pesticide Life Cycle Stage	Potential Source of Harm
Transportation & Distribution	• Sales by unregistered vendors • Sales of unregistered pesticides • Appropriately/accurate labeling • Proper staff training on proper transportation, storage, and sales • Lack of sales records documenting products (to determine registration and use limitations) • Lack of delivery documents with information on amount, number and names of distributed products • Lack of pesticide volume controls for transport, storage, and packaging • Lack of control over repackaging
Responsible Use	• Incorrect application rate or application timing • Used against directions (on crops or pesticides not specified on label) • Violation of product use restrictions • Failure to follow health and safety instructions (on label) • Out-of-date farming practices - End-user knowledge of product uses and legal requirements - End-use competency - Lack of user training • Inappropriate equipment • Label quality
Container Management	• Reuse of containers for storing food or water • Inappropriate disposition of containers • Unrinsed, abandoned containers • Lack of proper disposal techniques and facilities, including container return programmes
Disposal of Obsolete Stocks	• Improper disposal of obsolete pesticides

Source:
Developed from OECD Guidance on Pesticide Compliance and Enforcement Best Practices, 2012.

Identification, interdiction and prevention activities for illicit pesticides are complicated by the proliferation of pesticide products and industrial farm operations and the complexity of global supply chains as well as multiple forms of shipping for component ingredients and pesticides – as active substances, in bulk consignment or as finished packaged goods (with false or counterfeit labeling). Specific obstacles to effective interdiction of illicit pesticides include complex national and regional regulatory regimes for chemical substances, epidemiological understanding of the health, environmental and trade impacts, challenges in adherence to the *International Code of Conduct on Pesticide Management*[3], and the separation or diffusion of chemical and pesticide oversight across agricultural, environmental, health and other ministries that often do not have investigation or enforcement authority or sufficient resources to address all issues within their remit. Additional obstacles are regulator and consumer awareness of illicit pesticide market size and impacts; diffusion of responsibility across numerous agencies and geographic jurisdictions; difficulty in identification of illicitly destined chemical materials; inadequate regulation and penalties; and lack of resources for qualified personnel and equipment at customs or border control agencies. Identification and verification of illicit pesticides may be predicated on suspicions or information from third parties, most often pesticide companies, industry associations, distribution competitors, disgruntled customers, or other observers.

- Regulator and consumer awareness ;
- Epidemiological understanding of health, environmental and economic impacts;
- Diffusion of oversight responsibilities across agricultural, environmental, health and other ministries and agencies;
- Difficulty in identification and monitoring of illicit agro-chemicals;
- Conflicting and inadequate regulatory regimes (across national boundaries);
- Complexity of compliance with international codes, standards and regulations; and
- Lack of resources for qualified personnel, equipment and laboratory facilities/testing.

Table 2.
Obstacles to reducing threats from illicit pesticides

3. The *International Code of Conduct on Pesticides Management* recognizes the necessity of co-operative efforts to promote practices that minimize potential health and environmental risks associated with pesticides, while ensuring effective use. The Code incorporates voluntary good and best practice standards of Integrated Pest Management (IPM), widely considered integral to pesticide risk reduction, and Integrated Vector Management (IVM), a risk management process that seeks to improve the ecological soundness and stability, cost-effectiveness, and efficacy of vector-borne diseases.

Defining illicit pesticides

The term illicit pesticides describes an array of illegal, obsolete or banned substances, unauthorized imports, and counterfeit labeling for fake, inactive or inappropriate ingredients as applicable in the country of use. In most instances, mis-representation or mis-identification of chemical agro-inputs or plant protection products involves the infringement of Intellectual Property Rights (IPR) of a mimicked developer or rights holder. A variety of terms may be used to describe illicit pesticides[4]; the lack of definitional standardization for illicit pesticides impedes both a comprehensive understanding of market dynamics and concerted actions to control the worldwide illicit pesticide market. For the purposes of this paper, illicit pesticides are comprised of manufacture, import and sales of five (5) categories.

A. **Obsolete or banned non-authorized pesticides and substances;**

B. **Unauthorized pesticide imports[5];**

C. **Counterfeit or fake pesticides;**

D. **Re- or up-labeled pesticides; and**

E. **Refilled pesticide containers.**

Obsolete pesticides refer to chemicals that have been banned due to harmful health or environmental effects, degradation, deterioration, improper storage or subsequent re-formulation of product standard specifications. Worldwide, an estimated 225,000-500,000 tonnes of obsolete pesticides exist (Păun et al., 2014; Unsworth, 2010). Obsolete pesticides originate from a number of sources – excess user supplies, stored or warehoused products, trade and regulatory changes governing pesticides, and burials of disused or unused chemicals (formerly an acceptable disposal technique).

In most developed countries, producers are now legally required to manage stocks of obsolete chemicals and pesticides, although efforts to identify, collect and properly dispose of them have not resulted in total elimination. In developing countries, technical, institutional and financial capacities to operate necessary policy and regulatory oversight make it more challenging to identify and safely destroy obsolete stocks, and to mitigate waste contaminated sites (Păun et al., 2014). Lack of life cycle controls and legacy issues for these products mean that obsolete pesticides can be relatively easily injected into crop production and agricultural supply chains, regardless of capacities for regulatory oversight.

Unauthorized pesticide imports occur outside of authorized distribution channels, allowing products formulated for other markets to be sold, frequently at lower costs than authorized products. This makes legitimate products and retailers non-competitive in terms of costs, and reduces incentives for market participation by legitimate companies. Industry and regulatory reports suggest that unauthorized pesticide imports are a major source of the expanding illicit pesticide

4. Banned, counterfeit, illegal, parallel, repackaged, substandard, unapproved, unlicensed, unauthorized, unpatented and unregistered are the most frequently used terms to describe illicit pesticides. In the *International Code of Conduct on Pesticides Management*, WHO uses the terms substandard, spurious, falsely-labeled, falsified, counterfeit (SSFFC) with regard to illicit medical products (FAO and WHO, 2014).

5. Also known as diverted or gray market goods, parallel products are genuinely manufactured or licensed by a brand owner, however, they are subsequently imported into a non-authorized market or jurisdiction and disseminated through unauthorized distributors.

market, and a source of particular concern to pesticide IPR holders as they potentially undermine brand and reputational value in addition to the potentially harmful effects of unauthorized use (OHIM & Europol, 2012; Guyer and Davreux, 2012; ECPA, 2008).

Counterfeit pesticides refers to ingredients, chemical components or manufactured products whose origin or contents are deliberately misrepresented through false labeling and other forms of mis-identification or fraudulent presentation. This category also includes a range of products including those with no or less-than-labeled active ingredients, unlabeled and potentially illegal or banned chemicals, and other combinations of unidentified chemicals and unknown substances.

Re-labeled and ***up-labeled*** products are variations of counterfeiting and fraud that deliberately misrepresent product contents to avoid regulatory and consumer scrutiny by exploiting branded products and consumer cost-sensitivity. These products are frequently presented as more expensive pesticides in order to capitalize on price differentials with less costly products, and generally do not include content-appropriate instructions regarding safe use and storage.

Refilling legitimate pesticide containers and dispensing pesticides into non-approved containers are potentially deadly and criminal practices of illicit pesticide suppliers and distributors, as well as uninformed traders seeking to capitalize on bulk purchases. In developing countries, food or beverage containers are often re-used as their size and availability make them attractive for small farmers and household use. While this is a relatively small component of the illicit pesticide trade, potential harm from unwitting poison ingestion makes this an especially serious and complicating vector in terms of public health impacts.

Illicit pesticides are composed of imports and sales of five (5) types of products:

- ***Obsolete*** or banned non-authorized pesticides and substances;
- ***Unauthorized pesticide imports***;
- ***Counterfeit*** or fake pesticides;
- ***Re- or up-labeled*** pesticides; and
- ***Refilled*** pesticide containers.

Precursor and illicit pesticide products may be transported as active ingredients, consolidated bulk shipments, or as finished goods, complicating identification, interdiction and market control efforts.

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I. HUMAN HEALTH, ENVIRONMENTAL AND ECONOMIC RISKS

Health, food and safety risks

Agricultural chemicals present an array of risks associated with ingredients and chemical properties, use context, type and duration of exposure (contact, inhalation, ingestion), and other factors. Effects on human health can range from mild skin irritation to blood and nerve disorders, endocrine disruption, genetic changes, respiratory and tissue failure, coma and death. Improperly used, stored or disposed illicit chemicals and pesticides can amplify already negative effects of these substances by complicating treatment protocols due to unknown or untested compounds.

Since the development of the agricultural chemicals market after World War II, health, food and safety officials have been engaged with studying the health, economic and social costs and consequences of pesticides, most often as manifested in measurable pesticide residues. In 1975, the World Health Organization's *Recommended Classification of Pesticides by Hazard*[6] was approved: related *Guidelines* first issued in 1978 have been regularly updated. In 2002, the UN Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labeling of Chemicals (UNCETDG/GHS) approved *The Globally Harmonized System of Classification and Labeling of Chemicals*, a voluntary international classification system that defines physical, health and environmental hazards of chemicals and harmonizes the criteria for classification as well as standardizes the content and format of chemical labels and Safety Data Sheets. The 2009 revision of WHO Classification aligned WHO Hazard Classes with the Acute Toxicity Hazard Categories of the *Globally Harmonized System* (GHS) for acute oral or dermal toxicity as the predicate for allocating pesticides to a WHO Hazard Class. Recognizing the potential health, food and environmental risks posed by pesticides, national authorities require toxicology data for legal pesticide registration[7].

Health effects of exposure to chemicals and pesticides on agricultural and farm workers are increasingly well documented. Developmental and immune system concerns make children and pregnant women particularly at-risk groups. Direct or primary exposures may occur through inappropriate or unprotected application of pesticides, over-sprays, or leakage of improperly stored or contained chemicals as well as accidental ingestion. Indirect or secondary exposures may occur through the consumption of contaminated foods or water.

6. GHS/WHO Hazards fall into five (5) categories based on the levels of oral and dermal exposure and severity of harm, although WHO further distinguishes between solid and liquid products and the two systems have slightly different classification thresholds. WHO Classification categories are extremely hazardous (Ia), highly hazardous (Ib), moderately hazardous (II), slightly hazardous (III), and unlikely to present acute hazard (U). For additional details, see *The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009*. *GHS Revision 6* was issued in 2015.

7. For legal registration, data is required on the impact of the registered substance on human, animal and waterway health. These data requirements include levels for acute oral, dermal and inhalation toxicity as well as skin and eye irritation as sensitization. Acute poisoning can have deadly effects on central nervous systems, heart and circulatory systems, the gastrointestinal and uro-genital tracts as well as skin, hair and nails. In addition to reports of exposed, blood, urine and plasma tests can be used to identify the source of poisoning and exposure dose. Data on acute, sub acute, chronic, carcinogenicity, mutagenicity and teratogenecity are required for technical (active chemical) ingredients.

A primary health and safety concern in the regulation and control of pesticides involves the reduction and elimination of persistent organic pollutants (POPs) and highly hazardous pesticides (HHPs) with particular attention to health effects from consumer consumption of pesticides as reflected through MRLs. Bioaccumulation occurs gradually when chemicals or toxins are absorbed more quickly than metabolized by an organism. Biomagnification refers to increased concentration in a pollutant as it moves from one link in food chains to another. MRL is often set at detection level if use of a particular pesticide is not permitted in a specific country[8] (van derWulp, 2008).

Pesticide residues originate from a number of sources, including overuse and abuse of pesticides, use of inappropriate pesticides, use of contaminated water, and inappropriate application intervals or techniques. Limited farmer knowledge about pesticides and proper pesticide safeguards; availability and affordability of protective equipment; inability to apply Integrated Pest Management principles; and lack of knowledge of alternatives to pesticides all contribute to potential misuse, as does price sensitivity of farmers pressured by weather, production demands, and relatively small profit margins. Insufficient human, technical and financial resources to develop and enforce chemical regulatory control schemes have always characterized official responses to plant protection products, as market demands and product development necessarily precede efforts to understand and safely manage the potential unwanted effects of pesticides. Combined with strong pressure from commercial entities and agricultural producers on registration systems for pesticide approval and sales, opportunities for unprincipled and criminal actors abound.

Incidence of pesticide exposures is understood to be higher in developing countries as a result of a number of factors – insufficient regulation, lack of surveillance systems, lack of awareness and training for customs and law enforcement personnel, inadequate access to information systems for verification and information sharing, poorly maintained or nonexistent personal protective equipment, lack of farmer awareness, and larger agriculturally-based populations (Thundiyil et al., 2008). Like other disturbances to agricultural supply networks (such as production failures, shortages, destruction of crops, and mislabeled products), illicit pesticides are likely to disproportionately affect poor farmers, small farmers and consumers who have fewer alternatives, less disposable income, and generally less social recourse to remedy.

WHO has estimated three (3) million cases of acute pesticide poisoning annually, although lack of standardized case definitions and reporting systems complicate reliable estimations[9]. These occupational, non-intentional, and intentional (suicidal) cases[10] are thought to generate over 25,000 fatalities annually (WHO, 2014). Pesticide (over) exposure is a well-recognized public health issue, and a serious problem in numerous agricultural communities, particularly in low and middle-income countries. Over 90% of pesticide fatalities are thought to occur in developing countries (Meeghan, 2013). The use of illicit pesticides in these countries generates serious concerns and risks of human and ecosystem exposure to unsafe or substandard agricultural chemicals.

8. This means that MRLs may be used to identify illicit or sub-standard products in banned or regulated chemicals, however, MRLs are established only for authorized, regulated pesticides and therefore of little use in the detection of illegal, unauthorized or illicit pesticides.

9. Pesticide poisonings are underreported due to a variety of different reasons. Cases may not be identified as a result of the choice not to seek care for less serious cases, the access to healthcare, misdiagnoses, and worker expectation of ill effects in application. Lack of standardized reporting criteria, inconsistent incident classification methods, and the lack of standard case and clinical definitions also make it difficult to understand the true dimensions of the illicit pesticide problem, although non-governmental bodies, national authorities and industry members are actively engaged in developing and implementing chemical regulations and supervisory mechanisms. For illicit and illegal pesticides poisonings, health impacts and underreporting of exposures are potentially compounded further due to the inability to quickly identify compounds, sources, appropriate medical treatments, distribution networks, and other at-risk users.

10. In some countries (notably India, China and Sri Lanka), pesticide poisoning accounts for a substantial number of attempted and successful suicides (WHO, 2014).

For industrialized countries, the use of highly toxic banned pesticides, obsolete stockpiles (reintroduced into the market under false labeling or through illicit distribution channels) and improper storage techniques may present the greatest risk vectors (Thundiyil et al., 2008). Some research suggests that increasing use of higher quality pesticides in developed countries is associated with reductions in human health risks from pesticide leaching and runoff (Păun et al., 2014). Availability and use of higher quality pesticides may be driven by awareness of risk vectors by industry and regulators, financial capacity, and public awareness and expectations of environmental compliance and responsibility.

Threats from obsolete pesticides and POPs

Agriculture and food processing comprise a significant share of Moldova's economy. Despite banning the use of persistent organic pesticides in the 1970s, vast stocks of these and other obsolete pesticides remain.

The legacy of Soviet-era agricultural practices left thousands of tonnes of obsolete pesticides in at least 450 facilities. Dispersed chemicals and deterioration of storage facilities has contaminated soil and ground water in many parts of the country. Grain storage in former pesticides storage facilities and repurposing of facility materials into other structures continue to generate human and environmental health threats from direct and residual exposure, in addition to the possibility of continued use or distribution of these substances.

Under the leadership of the Moldovan Ministry of Defense and with support from numerous international agencies and countries, Moldova is actively engaged in a comprehensive and costly programme to inventory, consolidate and destroy these harmful chemicals (NATO, 2013).

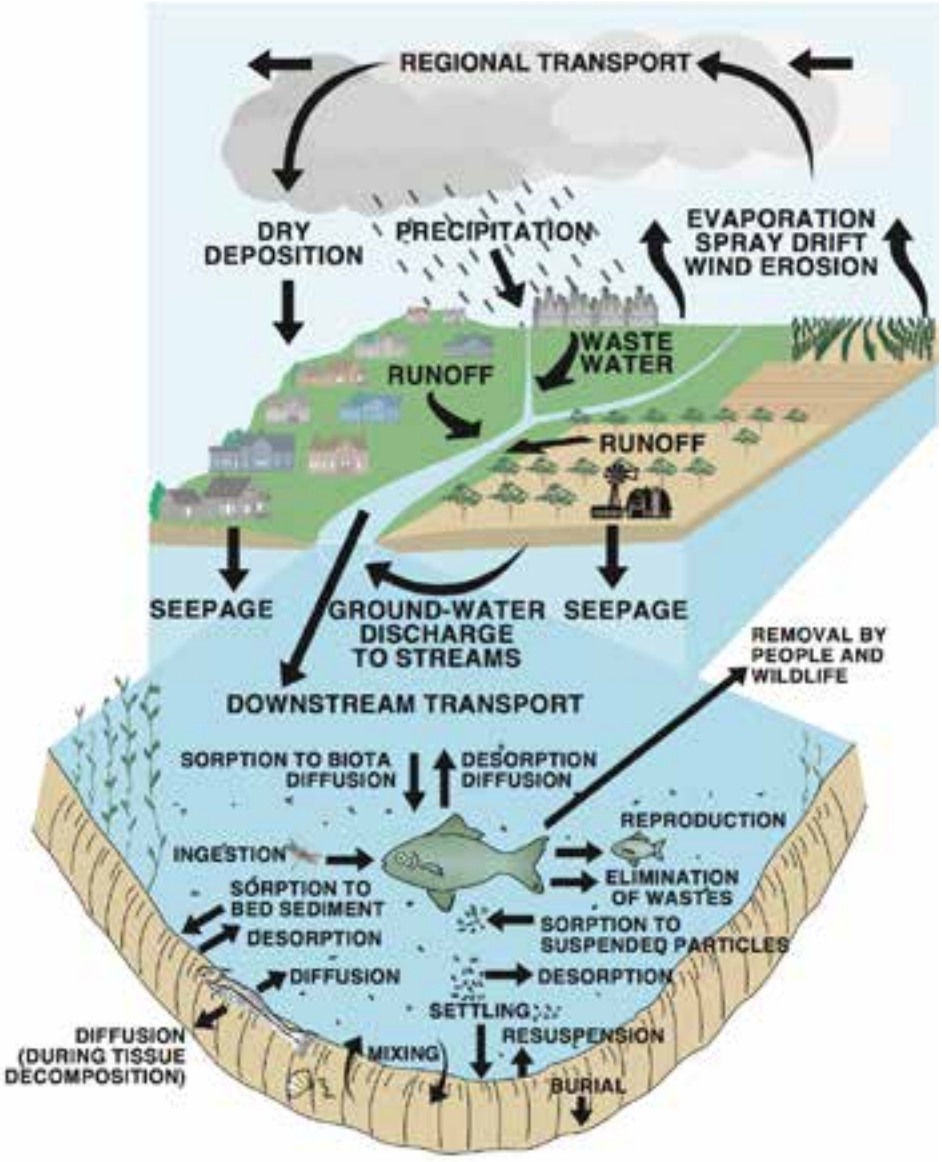
Environmental risks

Awareness and concern about the impact of pesticides on human and animal health and environmental systems is consistently reported as a public concern. Improperly managed, pesticides contribute to air pollution, contamination of ground water and riparian systems, and soil contamination in addition to negative impacts on non-targeted plants, birds, animals and marine life, particularly sensitive species.

Even properly used, pesticides can negatively impact fisheries resources, migratory birds, and habitats. Millions of birds and fish are estimated to die annually from pesticide exposure (Pimental, 2005). Certain pesticides have been implicated as a potential cause of

endocrine function disruption, amphibian decline and deformities, as well as decline in pollinator species. Restrictions and bans on pesticides, including highly hazardous pesticides, are not universal. Regulatory gaps generate potential for hazardous exposures, especially from the introduction and use of illicit pesticides.

Graphic 2.
Pathways for pesticides introduction into environmental systems



Source:
US Geological Survey, 2000

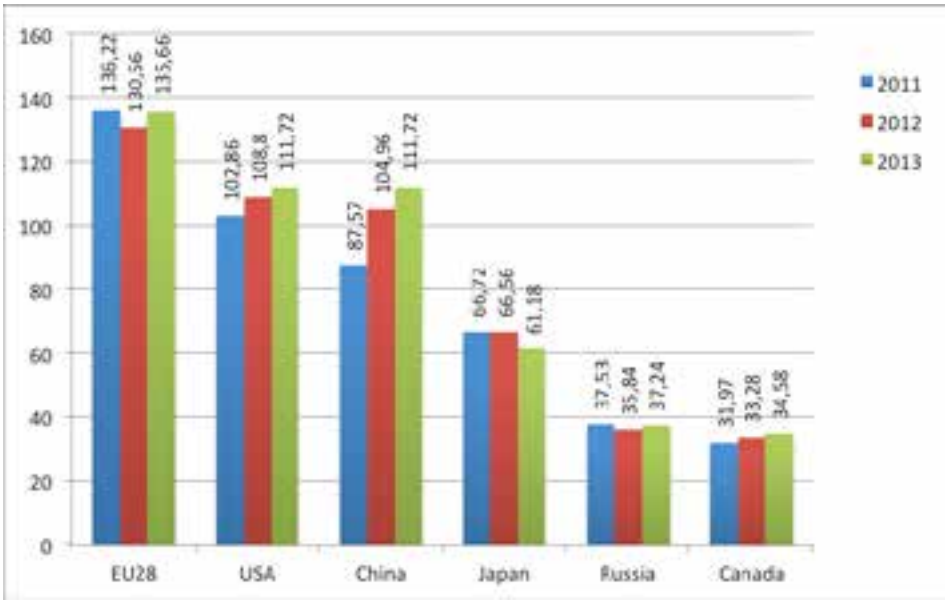
Damage to wildlife and fragile plants and ecosystems can occur through accidental, deliberate, or incorrect applications of pesticides. Aerial spraying increases drift and exposure to nearby people, plants and water systems. Toxic ingredients, inadequate storage and disposal of illicit pesticides introduce potentially hazardous waste streams into the food chain, farm animals, and waterways. Numerous national bodies and non-governmental organizations (NGOs) report significant pesticide levels in water sources, rivers and streams (Stone, Gillion and Ryberg, 2014; Malaj, von derOhe, Grote et al., 2014; UNEP & Pacific Institute, 2010).

Pesticides also may be intentionally used for wildlife control and even hunting, as they are relatively inexpensive, easy and, when used properly, quite effective. Predatory and profitable (e.g., poached) wildlife and unwanted or food source animals and wildlife may be targeted and killed through baiting carcasses, mixing grains and

salt licks with pesticides, and using pesticides to contaminate water sources. As a consequence, vulture (and other animal) populations in some places have been nearly eradicated by poisoning both through deliberate actions (to conceal the evidence of poaching by eliminating aerial circling that might alert officials) and inadvertently generated consumption of pesticide-poisoned carcasses (Ogada, 2014).

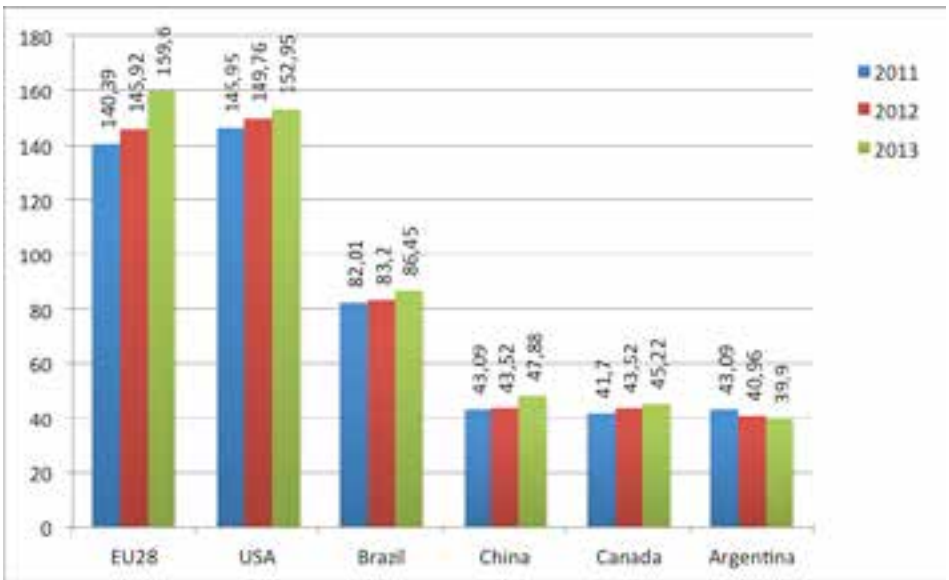
Economic risks

Agriculture is a huge and growing global industry by any number of measures –arable land, research and development of agro-inputs (seeds, pesticides, fertilizers), employment, export markets, IPR and profits (or losses) and product or brand reputation. The global agricultural products market was estimated to generate revenues of USD 2,228 billion in 2014 with anticipated growth generating market values of USD 2,907 billion in 2019 (Research and Markets, 2015). *Graphics 3 and 4* present a breakdown for the top six (6) world agricultural importers and exporters.



Graphic 3.
Top 6 world agricultural importers, 2011-2013 (USD, billions)

Source:
European Commission, 2014 [converted from Euros]



Graphic 4.
Top 6 world agricultural exporters, 2011-2013 (USD, billions)

Source:
European Commission, 2014 [converted from Euros]

The pesticide world market is approximately estimated to generate revenues of USD 60 billion, and growing. Agricultural use is estimated to account for 86% of pesticide sales worldwide (AGROW, 2007). There are a number of economic implications from the growth in illicit pesticides. For governments, a particularly important concern stems from lost revenues from uncollected taxes. Lost revenue reduces regulatory capacity and enforcement resources. In 2006, the European Crop Protection Association (ECPA) estimated the revenues from counterfeit and illegal plant protection products in Europe at between USD 450 to 640 million and annual lost tax revenues (based on an average 6% VAT rate on the sale of PPPs) of USD 26-38 million (ECPA, 2006).

Illicit and counterfeit products in the market may also restrict commercial development and innovation. Developers and producers unable to recoup research investments or to protect IPRs in specific markets may withdraw from market participation. In addition to reducing research and development incentives and activities, pesticide withdrawals can negatively affect the availability of effective and appropriate products for consumers. Studies suggest that greater developmental and regulatory requirements have been somewhat successful at encouraging crop protection practices with fewer health and environmental risks, although it is not clear that incentives and regulations encourage the optimum research and development investments for improving agricultural chemicals or alternatives to pesticide use (Zilberman and Millock, 1997). For example, higher fixed costs of regulation might lead the industry to focus research and development on more complex or difficult compounds with greater commercial potential, or to abandon research and development for smaller markets, such as those involving specific or specialty fruit and vegetable crops (Ollinger and Fernandez-Cornejo, 1995, as cited by USDA, 2011).

Illicit and banned pesticides can destroy crops, contaminate waters and soils, devastate markets for particular products and erode public confidence in established producers, agricultural producing countries and regions, perceptions of food safety, as well as cause reputational damage to established food producers, products, and brands. MRLs out of tolerance for banned and registered pesticides may cause a food crop or product to be rejected at import or distribution levels. This generates economic losses to the farmer and the exporting company as well as requiring the costs of safe destruction of contaminated crops. Certain crops and markets are particularly sensitive to pesticide residues. Recently, concerns over regulation of pesticide residues in cocoa and rejections of shipments by Japan and EU due to the discovery of high levels of prohibited chemicals have resulted in increased awareness, government and industry programmes, and farmer cooperative efforts to use appropriate pesticides more judiciously, increasing both the efficiency and effectively of pesticide use (Afrane and Ntiomoah, 2011).

Illicit pesticide contamination and market impact

The most widely known example of illicit pesticide contamination and market impact involved detection of traces of an illegal substance (isofenphos-methyl) in pepper samples imported to Germany from Almería, Spain in 2006 (ECPA, 2008; OHIM-Europol, 2012). Traces were subsequently detected in peppers in 12 other countries, including Finland, Netherlands, UK and Russia.

As a result of media coverage and consumer concerns, Spanish pepper exports dropped almost 20% with a price decrease of up to 60%. In addition to stopping sales of the peppers, the Spanish government launched an intensive investigation that resulted in production stoppages, criminal charges and fines for the implicated farmers. Within a year, Spanish environmental police seized an additional 2,200 liters of mixed illicit pesticides and made corresponding arrests (ECPA, 2008).

This case raised international awareness of the problem of illicit pesticides and the complexity of challenges related to identifying and controlling the lucrative international trade.

There is some debate about the appropriate regulatory path for plant protection products, and related concerns that lack of availability of effective pesticides may drive misuse or overuse of less effective products. Precautionary risk management, or the *precautionary principle*, is designed to achieve the highest levels of health and environmental protections through prevention, and highlights the delicate and challenging balance between science, public policy, and consumer demands. The precautionary principle stipulates that if a policy or activity is suspected of causing harm to public health or the environment, in the absence of scientific consensus to the contrary or definitive scientific evaluation of the risk, preventative action is indicated.

In terms of pesticides, application of the precautionary principle might involve distribution stoppages or product withdrawal. For foods, food additives, medicines and pesticides, the precautionary principle places the responsibility for proof of the absence of harm on producers, manufacturers and importers. Opponents of this approach argue that the application of this principle to pesticides, and corresponding, unreasonably limits the appropriate use of effective products (e.g., use of DDT to control malarial mosquitoes). This approach also potentially restricts incentives for development of alternative products due to legitimate concerns about product authorizations.

Special security considerations

Additional security concerns specific to illicit pesticides transport and distribution involve crew and cargo safety, public safety and national security. Particular components of agro-chemicals (fertilizers and pesticides) can be used to manufacture explosive devices. "Transportation of wrongly labeled chemical products may pose a significant risk to logistics companies, and also to emergency services in case of an accident" (Gywat et al, 2014, p. 23). In 2013, Customs and Police administrations seized more than 114 metric tons of solid chemicals and nearly 13,000 litres of liquid precursors. Two highly hazardous precursors accounted for over 90% of 2013 seizures[11] (WCO, 2014).

Transportation of illicit pesticides and chemical cargoes has dramatic implications for crew and vessel safety, intellectual property rights holders, investors, farmers, and consumers. Failure to successfully store and safely ship hazardous chemicals can have disastrous and expensive results (for shipping operators and responding agencies, not illicit operators). Fires on the Maersk *Charlotte*, Hanjin *Pennsylvania* and Hyundai *Fortune*, were reportedly caused by mislabeled hazardous materials (BASCAP, 2015).

Security in the supply chain is critical in both the context of an extreme event, such as an attack or significant natural disaster, but also for less severe, more common events, such as theft, quality control, sabotage, information breaches, and threat of counterfeiting. However, the size and extent of the global supply chain infrastructure makes total protection against loss or hazard impossible and financially impractical.

Agricultural and food supply chains are critical infrastructure elements for every country. Infrastructure protection activities must be informed by recognition of the interdependencies of industrial sectors and global markets as well as threats of catastrophic disruption due to natural disasters and deliberate acts of sabotage and terrorism. Increasingly frequently, regulatory authorities and industries are taking a risk management approach that identifies and prioritizes assets, threats, and vulnerabilities and organizes activities to protect (differentially) critical, prioritized assets. Enlightened national and industry self-interest, asset, brand, and market protection, customer security and assurance requirements, and government efforts are key drivers for the implementation of security measures to address potential economic losses and health harms from illicit pesticides throughout the supply chain.

11. Over three quarters of seizures of high risk chemicals in 2013, including ammonium nitrate and potassium chlorate, were reported by Afghanistan, with the remainder by Kyrgyzstan, Mali, Montenegro and Thailand. Additionally, 20 pre-made improvised explosive devices (IEDs) were seized with 28 corresponding arrests (WCO, 2014).

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II. ILLICIT PESTICIDE MARKETS AND SERIOUS ORGANIZED CRIME

Organized Criminal Groups operate in a criminal market economy, and exploit opportunities to commit lucrative fraud, counterfeiting and related offenses against consumers, public authorities and legitimate businesses. Flexible and adaptable, these groups and networks respond quickly to opportunities from political, economic, or legislative changes, including free trade agreements and free trade zones (FTZs), differential regulation and product pricing schemes between jurisdictions, and market growth potential.

The United Nations Convention against Transnational Organized Crime (UNTOC) identifies several characteristics of an "organized criminal group", although the Convention itself avoids a precise definition of the term in order to allow for broader applicability of the Convention with respect to the continual emergence of new types of crime facilitated by global, regional and local dynamics and the need for cooperation on a wide range of common concerns. Characteristics of organized criminal groups include a group of three or more persons that was not randomly formed, that exists for a period of time, and that acts in concert with the goal of committing at least one crime in order to directly or indirectly obtain financial or other material benefits . According to the definition of UNTOC an offence is transnational in nature when a) it is committed in more than one State; b) it is committed in one State but a substantial part of its preparation, planning, direction or control takes place in another State; c) it is committed in one State but involves an organized criminal group that engages in criminal activities in more than one State; or d) it is committed in one State but has substantial effects in another State.

Europol (2015) indicates a changing dynamic in the structure of organized crime, from traditional hierarchical groups to a more fragmented and global criminal market in which ethically challenged and malleable networks of criminal entrepreneurs and enterprises organize to exploit market opportunities, increasingly often using digital technologies to facilitate and conduct illicit trade. Transit to markets (as component ingredients or finished products) and distribution to consumers are both essential to a profitable trade in illicit pesticides. Actively seeking to avoid official scrutiny from regulatory and enforcement actions, operators obscure their activities with shell companies, falsification of paperwork, rerouting shipments, and shipping constituent parts and elements separately (e.g. constituent elements, product and/or labels).

Recognizing the expansion of illicit products into comestible

and agricultural supply chains and networks, the European Council has mandated "Counterfeit goods, violating health safety and food regulations and substandard goods" as a key organized crime priority for 2014-2017 (Europol-OHIM, 2015, p. 26). The size of the trade, combined with the state of development of chemical and pesticide regulatory systems and regimes, industrial oversight systems, and inconsistent health and environmental monitoring, makes illicit pesticides an important and ongoing challenge to producers, regulators, distributors and users.

As the world value of the legitimate pesticides industry is approximately amounting to USD 60 billion (FAO, 2012), there are a variety of market and strategic incentives for organized criminal groups and networks to produce and distribute illicit goods, including pesticides. Profit margins are high – with none of the traditional costs or liabilities associated with developing, producing and marketing a brand-name product. Estimates of the worldwide market for illicit pesticides range from USD 6-10 billion annually (based on a 10-15% of market estimate) and the European market accounts for approximately USD 1.1 billion (Moss, 2013). Precise figures of profit for specific entities or enterprises are difficult to generate unless their operations are interdicted by law enforcement. In one seizure in Kursk, law enforcement seized almost 100 tonnes of illicit pesticides, estimating the market value at USD 1 million (BASCAP, 2015). In Italy in 2006, fake labels on a legal, less costly product, facilitated sales at a 900% price market up with an estimated 1,000-2,000 litres sold (ECPA, 2008).

Attractive profit margins in the illicit pesticides trade also contribute to conspiracy and corruption of responsible authorities in law enforcement, customs, company staff and those in charge of pesticide procurement (OSCE, 2015). In late summer 2015, investigations in Punjab (India) into the role of pesticides in whitefly devastation of cotton crops resulted in arrests and charges (cheating, criminal breach of trust and criminal conspiracy) against several prominent agricultural officials involved in reported serious irregularities in the purchase of subsidized pesticides for distribution to farmers. Cash was seized from the home of the Agriculture Director, who allegedly overcharged the government for subsidized pesticides and took money to renew contracts for product licensing without proper tendering for bids (Gopal, 2015; Haq, 2015).

Unauthorized pesticide importing, counterfeiting and associated activities are relatively low-risk criminal ventures with generally minor legal, financial, or criminal consequences. Penalties vary markedly by country, and, in some countries, products deemed not harmful to human health may be allowed to be returned to the supplier or country of origin. In 2011, Germany authorities indicated that marketing plant protection products without authorization or without parallel import approval might incur a maximum penalty of USD 56,000 (OHIM & Europol, 2012). In Ireland in 2008, a consignment of unregistered plant products was seized as a result of industry complaints, however, as the substance had no negative health implications and it was a first offense, the distributor was allowed to return the shipment to the supplier (OECD, 2012).

There are low barriers to entry for many products, especially because there are no quality or regulatory constraints, taxes or tariffs, or concerns and responsibilities for the safety and integrity of source materials and finished products. In 2013, Irish authorities seized and destroyed thousands of liters of illicit pesticides, although regulations may require that storage and destruction costs for counterfeit goods are the responsibility of IPR holders, rather than the criminal enterprises that distribute the goods (Europol-OHIM, 2015). In 2006 in Ukraine, seized products that did not pose a threat to public health could be auctioned, presenting another opportunity for distribution of unauthorized products through the supply chain (ECPA, 2008).

Illicit market participants are responsive to official surveillance and risk profiling by changing routes, labeling, and operations to avoid detection and interdiction. These factors make counterfeiting an especially attractive option for organized crime groups and criminally-inclined enterprises that can take advantage of commercial scale opportunities presented by extensive transportation, assembly/labeling, and distribution capabilities and capacities spread over multiple geographic locations.

Seizure of counterfeit pesticides and re-packaging materials

In 2008, police raided a facility near the city of Kursk, Russia and discovered almost 100 tonnes of counterfeit and illegal pesticide products with an estimated market value of nearly USD 1 million. Markings on the seized containers indicated likely manufacture in China.

Most of the products seized were illegal copies of patented and branded products from major legitimate manufacturers - pre-packed into containers, ready for commercial sale. The police also uncovered equipment for applying labels and stickers to containers and other packaging equipment.

Subsequent investigation indicates that transport routes to Kursk may be different based on consignment. Illicit products may arrive by sea or by road, and some may be shipped through an EU port (BASCAP, 2015).

Illicit pesticides and the supply chain

Illicit pesticides are intentionally prepared from component and raw materials or legally manufactured pesticides, and then disseminated through shipping routes and supply chain links facilitated by transport operators and distributors. At intermediate and final destinations, illicit pesticides are formulated or assembled, packaged or repackaged (including application of labels) for unregulated, unauthorized or otherwise illegal distribution. At each of these stages, vulnerabilities

in market controls and oversight are exploited by motivated criminal networks.

Chemicals industries comprise one of the largest global industrial sectors. Over the past decade, China's share of the chemicals industry has grown from less than 10% to almost half of world sales, including industrial, medical and agricultural chemicals. Including all Asian chemical production, the region accounted for over 55% of world sales in 2012[12] (Cefic, 2014). China produces over 1150 chemicals that constitute 98% of all pesticides registered in the world (FAO, 2014). Therefore, China is also frequently mentioned as the primary source for illicit pesticides (Europol-OHIM 2015; ECPA, 2008).

Control efforts and prosecutions in China as well as enhanced inspection controls in ports have resulted in organized crime tactical changes in the distribution of illicit pesticide products, including components being shipped separately through multiple ports to obscure content, origins, and identity before landing in the ultimate market for the product. Consequently, illicit plant protection products appear to be more frequently assembled near the point of sale to avoid detection at border controls (Europol-OHIM, 2015; Moss 2013). This potentially diffuses the distribution of both precursor and final products more broadly and through less-scrutinized ports and methods of entry.

Import of unregistered (unauthorized) pesticide

Unregistered Glyphosate from China was imported into Canada and resold for personal profit. The Pest Management Regulatory Agency (PMRA) became aware of this illegal activity from industry complaints.

The importer admitted importing and resaling illegal Glyphosate to a retailer. The product was detained. A Compliance Order was issued ordering the return of this product to the original distributor in China and three Notices of Violation with Penalty for the import and sale of an unregistered product were issued.

The importer paid the monetary fines, but did not take the required steps to dispose of the illegal product as defined in the compliance order. After lengthy correspondence with the importer, preparations were made to confiscate the product and arrange for its disposal. Before PMRA could confiscate the product, the importer reported it as stolen from the storage facility. The entire investigation was turned over to the police. International counterparts were notified (OECD, 2012c).

Recognizing increased scrutiny for illicit products, including pesticides, organized criminal suppliers and distributors use a number of strategies to evade detection and interdiction, including shipping components separately for assembly and packaging at destination, using digital and online technologies to conceal product identification and ownership, and exploiting weaknesses in oversight and control within legitimate supply and distribution chains.

12. Pharmaceutical chemicals constitute a related concern due to reportedly large percentages of counterfeit, substandard, fake and illicit medicines. The European Fine Chemicals Group (EFCG) estimates the world market for active pharmaceutical ingredients (APIs) is USD 37 billion with Europe's share standing at USD 14 billion (38%). Currently, approximately 70% of APIs consumed in the EU come from Asia – mainly China and India – where factories are rarely inspected for compliance with EU standards by EU authorities, placing EU compliant manufacturers at a competitive disadvantage (Europol-OHIM, 2015).

The global supply chain is complex for legitimate products. Up to twenty-five different entities - ranging from manufacturers to shippers to distributors - may participate in the average global supply chain (Russell and Saldana, 2003). Even domestic shipments and those within free trade zones can have extensive itineraries that involve multiple shipment, assembly, and distribution points. The number of parties, transfers, and stops involved in chemical shipping and transactions complicates the identification, regulation and control of hazardous and pre-cursor chemicals for medicines, pesticides, and explosives that have significant legitimate commercial applications and customer bases. The complexity of legitimate supply chains amplifies the challenges of identifying illicit goods within them, as organized criminal groups and networks are experts at manipulating the legitimate supply chain and disguising the origin and provenance of goods.

A significant number of all illicit products move through supply chains and consumer networks without detection or seizure due to misrepresentation of goods on packaging or fraudulent shipping documents. Regulators and border inspectors are challenged by small package volumes and unfinished goods that reduce the effectiveness of traditional detection and seizure strategies. Lack of timely action by rights holders for small package detentions combined with separate distribution through post and courier of ancillary items, such as certification marks, labels, and empty packaging, may circumvent or diminish the identification of counterfeit and illicit goods (Europol-OHIM, 2015).

Import of banned and unlicensed pesticides

The Bundeskriminalamt (BKA) reported that Hamburg import authorities detected nicotine sulfate and an unlicensed pesticide, Daminozid, during an import control search. Investigators discovered and seized almost 20 tonnes of nicotine sulfate, which had been declared as a licensed fertilizer, calcium cyanamide (or more commonly, lime nitrogen). Nicotine sulfate is highly toxic and harmful to human health; even very small doses can be deadly. Some of the seized barrels were featured counterfeit labels.

Subsequent investigation indicated that OCG operations had earned at least USD 1.5 million over two years through the importation of nicotine sulfate from multiple countries (Belgium, China, India, Portugal, Spain and the UK) and distribution to buyers in Germany, the Netherlands and Poland (Europol-OHIM, 2015).

Several factors contribute to relative ease of willful distribution, transportation or sale of illegal pesticides – including;

- lack of universal standards for proper documentation and/or certification (of chemical legality or registration in specific markets) at the transporter or distributor level;
- insufficient awareness, recognition of harms, and expertise throughout the transportation and distribution chain to make

identifications of illicit products;

- lack of resources and technical identification techniques at borders, re-loaders, retailers and end-users; and
- lack of product registrant oversight, or certification of hired transporters or distributors (OECD, 2012).

As with legitimate global businesses, transnational criminal networks and organizations form mergers, alliances, and partnerships to optimize and exploit opportunities. Production, assembly and consumption may be geographically dispersed over thousands of miles with no legitimate trail to trace. Anonymity and distance generated by extended supply chains, falsified documentation and online sales create temporal lags from the discovery of a pesticide-related incident or illness to its identification and resolution (determination of cause, subsequent product tracking and recall or seizure, casualty treatments, risk communication and consumer notifications). With inaccurate or falsified documentation and shell companies obscuring contents and origins, illicit pesticides present severe investigation and capacity challenges to international markets and globally extended agricultural supply chains.

Staying ahead of counterfeiter innovations is difficult, as there are numerous ways to bypass internal production, third-party quality controls, and regulations (i.e., falsification of data, substitution of inferior products) in the absence of continual, direct oversight and a cultivated awareness of the issues and consequences. Illicit pesticides also present difficulties in proper identification at points of distribution and sales. These products may be hidden in non-inspected storage or sold only to known customers and partners. Receipts may indicate legally registered pesticides but differ from packaged and distributed contents. Illicit pesticides may be detectable only through chemical analysis, further complicating identification and control efforts. Additionally, online and internet sales of illicit pesticides may involve relatively small volumes or counterfeit labeling that are distributed through legitimate postal, package and shipping carriers. The Internet and e-commerce have become major enablers for the distribution and sale of counterfeit goods (Europol-OHIM, 2012), including potentially illicit pesticides, which represents another particular and growing concerns to regulatory and enforcement authorities.

In-transit status for product shipments (passing through non-destination points) can create legal obstacles to seizure of illicit products and precursors before final destination, as customs and regulatory officials in certain jurisdictions have no way (or legal authority) to confirm the ultimate intended destination, product, use or disposition of the chemicals in question. Distribution warehouses and self-storage facilities may be misappropriated for the assembly and distribution of illicit products, suggesting that property holders may also have special due diligence obligations to insure both the safety and legitimacy of products stored in their facilities.

Other distinctive challenge can arise from seizures of illicit pesticides. For legitimate IPR holders, this may mean bearing the costs of

illicit pesticide detection, storage after seizure, product disposal or destruction. This constitutes what may be considered a perverse penalty. Special disposal procedures may, in fact, cost more than production, and some companies have reportedly asked enforcement agencies to stop seizing infringing products, resulting in the release of product into markets (Europol-OHIM, 2015). Further, some national regulations allow the recall (and subsequent export) of revoked products, release to market of products determined to be non-harmful, or the return of products to first-time offenders (for potential re-release) into supply and distribution chains.

From regulator and industry perspectives, illicit pesticides present special challenges in the application of appropriate product regulations, and determinations of product authorizations and authenticity. One of the most daunting aspects of interdiction and control of any illicit trade is identifying illicit cargo within the vast volumes of worldwide air, maritime, rail and road cargo shipments in the context of expanding world markets, logistics networks, free trade zones and variable national regulatory programmes. Traditional control programmes have focused on manufacturing controls, import inspection and controls, and in-market distribution controls. The volume of the illicit pesticides trade indicates that enhanced control strategies and techniques are needed. Recent efforts to seize goods under smuggling, rather than IPR regulations, to make shippers responsible for storage and destruction costs, are receiving favorable attention and response from rights holders and enforcement authorities. Other promising approaches involve assessing toxic and hazardous waste disposal charges to manufacturers and distributors of illicit pesticides and the use of civil and criminal asset forfeiture and confiscation from persons and entities implicated in and convicted of illegal activities (BASCAP & UNICRI, 2013).

A mapped example of transshipment (see *Graphic 5*) by a Russian OCG of pesticide precursor chemicals from China to Slovenia to Ukraine for final assembly, packaging, labeling and distribution (Europol-OHIM, 2015) demonstrates the geographic complexity and multiple steps used to disguise the origins and intent to manufacture illicit pesticides, the use of multiple forms of transport, and adaptive efforts to assemble illicit goods at or near the point of destination to further avoid detection.

1 - Russian OCG
2 - Chemical manufacture in China
3 - Chemicals shipped to Port of Koper (Slovenia)
4 - Transported by truck to Ukraine for final assembly and packaging

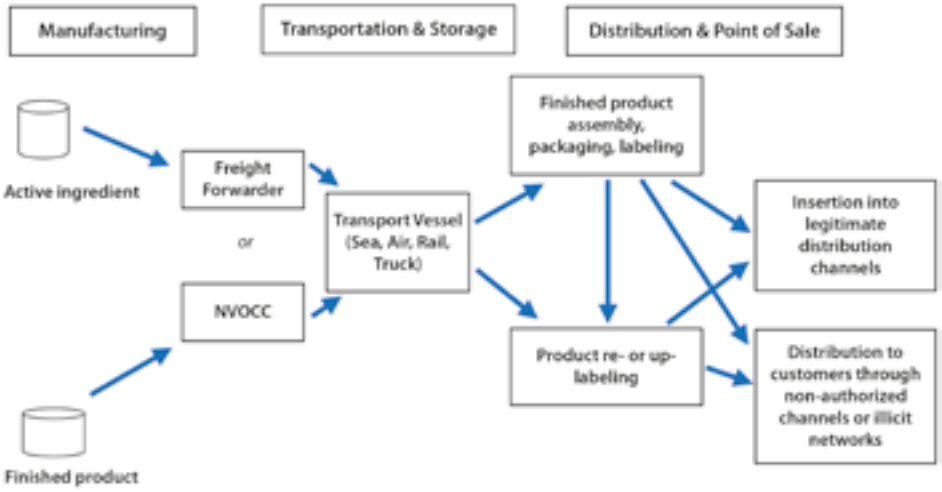
Graphic 5.
Sample transshipment route for illicit pesticides

Source:
Europol-OHIM, 2015

Due to transportation costs and product volumes, a majority of goods worldwide are shipped by sea, an estimated 9.9 billion tonnes in 2013 (Statistica, 2015). However, illicit pesticide seizures also occur in air, rail and truck transshipment routes. Complex methods and routes used to traffic illicit pesticides indicate the criminal intentions of the actors involved and suggest a range of criminal actors, from loosely organized groups to highly organized crime networks, conducting a majority of illegal trans-border shipments. Seizures of illicit pesticides represent an important opportunity for customs authorities and law enforcement agencies to use established elements of national regulatory regimes and supply chain features to gain insight into specific sets of actors, shipping routes and strategies, and to reduce trade in these products.

Dynamics of the ocean-going cargo and other transport industries present complicating features in the identification and interdiction of illicit cargos, including pesticides. There are several methods that producers use to ship products to market overseas. Larger producers may contract directly with shipping companies and operators. Smaller producers who do not meet full-container load (FCL) requirements may use brokers, freight forwarders (FFs) and non-vessel operating carriers (NVOCCs), to aggregate small or less-than-container load (LCL) shipments and generate cost-effective shipment options. Freight forwarders and NVOCCs are intermediaries that provide a variety of services to simplify and expedite customs processing, required declarations and supporting paperwork, consolidation of shipments and reduced shipping times. However, both sole sourced and bundled shipments can be packaged to obscure the origin and contents of container goods and conceal the ownership of illicit goods and precursors. Given the complexities of global supply chains, effective enforcement necessitates investigations that span the entire supply chain, from production to product use and sale. *Graphic 6* demonstrates how illicit precursor chemicals and finished products can be moved through supply chains.

Graphic 6.
Illicit pesticide pathways through the supply chain



Recent control efforts have begun to focus on the role of these and other intermediaries in illicit product distribution and to explore the legal responsibilities of these intermediaries in transporting illicit products through expanded requirements governing both product

and customer verification and authentication (BASCAP, 2015; Wilson and Kennedy, 2015). These strategies include manufacture-oriented regulation and monitoring of forwarders and NVOCCs through Know Your Supplier (KYS) programmes such as customer verification requirements, product authentication and verified marks labeling, technical tracking obligations, and adoption of international voluntary standards (BASCAP, 2015). An extension of traditional financial transactional monitoring techniques, Know Your Customer (KYC), has also recently been proposed as a promising mechanism to better control subterfuge techniques for illicit product shipments within legitimate supply and distribution channels (BASCAP, 2015; Wilson and Kennedy, 2015).

Recognizing the corrosive effects of illicit products on legitimate markets, industries are expanding voluntarily adopted Corporate Social Responsibility (CSR) programmes to better govern raw material acquisition and use, production and labor practices, and industry-initiated controls. These activities represent ongoing efforts by industry to ensure product integrity and to avoid enhanced regulation through creating voluntary incentives for policies, standards and practices to guide and govern industry operations.

Regional profiles and illegal pesticide trends

Each country and locality has its own pesticide market and use dynamics based on its level of development and regulation, type of crop production, local practices and available plant protection products. Characteristics of agricultural markets, farm and pest management practices exert significant influence on the type and scale of problems presented by illicit pesticides, as does the size and scope of online pesticide sales within any market. Many developing countries are rapidly expanding pesticide use in conjunction with agricultural sector development and growth (see *Table 3* below). This section briefly describes the major dimensions and challenges of illicit pesticide use by region, and concludes with *Table 4* that summarizes key regional issues.

Table 3.
Annual pesticide exports and imports by region, 2008-2012

EXPORTS	2008	2009	2010	2011	2012
Africa	177,702.17	198,731.89	228,632.44	290,529.23	381,285.45
Americas	4,439,308.44	3,960,838.98	4,527,449.76	4,805,449.78	5,316,645.68
Asia	5,329,165.87	4,504,829.11	5,311,993.90	6,407,315.88	7,314,353.84
Europe	14,565,212.01	12,702,142.34	12,747,166.99	15,895,583.01	15,695,009.61
Oceania	164,862.70	145,213.44	183,746.73	222,663.84	357,305.63
World	24,676,251.19	21,511,755.76	22,998,989.82	27,621,541.74	28,964,602.41

IMPORTS	2008	2009	2010	2011	2012
Africa	1,279,277.44	1,420,666.37	1,595,331.68	1,989,961.02	2,118,963.76
Americas	6,375,567.76	5,888,451.83	6,621,895.68	7,456,980.52	8,141,979.68
Asia	4,320,760.82	4,337,921.01	4,886,282.15	5,689,420.14	5,878,869.32
Europe	12,797,933.50	11,297,081.36	10,866,895.86	13,691,684.27	13,669,996.05
Oceania	601,322.07	503,121.52	676,111.67	841,153.65	856,811.73
World	25,374,861.59	23,447,242.09	24,646,517.04	29,669,199.60	30,666,620.53

TOTAL MARKET	50,051,112.78	44,958,997.85	47,645,506.86	57,290,741.34	59,631,222.94

Source:
FAO-Knoema resource statistics, pesticides trade, 2015

Africa

Africa is projected as the world's most promising agricultural producer, consequently, the trade in illicit pesticides is already a major public health and economic concern in the region. National farmer and industry associations in Africa report about 15-20% of the market is illicit, with particular hotspots where parallel imports, illicit chemicals and counterfeits may temporarily account for up to half or more of the market for pesticides (Guyer and Davreux, 2012). Seizures and reports of illicit pesticides have occurred in at least 15 countries, including Ghana, Tanzania, and Uganda. In one country of the region, illicit pesticides distributors constitute the biggest competitors for market share: in some countries, small scale backyard preparations of fake products and refilling of containers constitutes a relatively small, if especially deadly, part of the illicit pesticide problem (Guyer and Davreux, 2012).

When the quality of labeling and packaging is considered, the

proportion of poor-quality pesticide products marketed in developing countries may even be higher than estimated. In 2011, more than 80% of the countries surveyed in Africa indicated that they have concerns regarding trade and use of substandard and counterfeit public health pesticides, although only 40% of African countries have national pesticide quality control facilities (WHO, 2011). Additionally, quality control of public health pesticides and application equipment is often inadequate.

These features make this market especially attractive to organized criminal groups willing to exploit them. Authorities do not have extensive capacity or resources to effectively regulate and monitor pesticide imports and distribution. Farmers are cost-sensitive and may find lower priced goods or smaller containers more attractive or affordable.

Americas

For developing agricultural markets in the Americas, particularly Central and South America, illicit pesticides present risks similar to those found in developing countries in Africa and Asia. As the leading agricultural exporter for the region, Brazil has experienced explosive growth in agriculture production and corresponding increasing in pesticide use. In 2014, Brazilian authorities made a huge seizure of illegal pesticides after an inspection of 252 farms in 30 counties, resulting in fines, and arrests with police reports forwarded to prosecutors for further actions (Pucci, 2014). Illegal pesticides are a real concern in Argentina, Brazil, Paraguay and Uruguay among others. Problems with health effects from pesticides are widely reported in agricultural populations in Central and South America.

For developed agricultural markets in the Americas, illicit pesticides represent a relatively small risk due to market regulation, product alternatives, farmer education, and consumer awareness. However, cross-border and online shopping can facilitate the consumer trade for illegal pesticides on a commercial and consumer level. Developed detection capacities and more articulated legal mechanisms for monitoring and redress result in investigations and seizures of fake, unregistered, banned and counterfeit pesticides, although cases are also predicated on reporting by competitors or dissatisfied customers rather than regularized product monitoring and testing by authorities.

In the United States (US), the Environmental Protection Agency (EPA) evaluates registered pesticide products for safety on a national level, conducts investigations, and enforces regulations under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). In conjunction with Customs and Border Patrol, the EPA also monitors and interdicts imports of unregistered and improperly labeled pesticides. On their websites, the EPA and National Pesticide Information Center (NPIC), warn about illegal pesticides and insecticides that may be sold on the street or in small neighborhood stores, including insect and mice killers, flea and tick repellents, mothballs, and other similar products.

Individual states may establish MRLs at more stringent than national levels. In California, a major national and international agricultural producer and the state with among the most stringent environmental and agricultural regulations, the most recent annual random commodity testing under the state's Pesticide Residue Monitoring Programme found that 5.5% of samples had traces of pesticides not approved for specific commodities (CDPR, 2014). Three of the twelve commodity/country-of-origin combinations with highest percentages of illegal residues were from the U.S.; the remainder originated from Mexico (8) and China (1). Upon detection of illicit pesticides, authorities quarantine crop lots and try to remove tainted products to prevent consumption. In summer 2015, the Department of Pesticide Regulation fined six companies that had ignored previous warnings and "repeatedly sold imported fruits and vegetables with illegal pesticide residues to predominantly ethnic minority customers" (CDPR, 2015). Fines ranged from USD 10,000 to 20,000.

In Canada, the Health Canada Pest Management Regulatory Agency registered pesticides after evaluations, re-evaluates marketed pesticides on a 15-year cycle and promotes sustainable pest management. Individual provinces regulate the application, sale, and storage of pesticides within their jurisdictions. Following the lead of Quebec and Ontario provinces, over 200 municipalities had placed restrictions or bans on synthetic and chemical pesticides for cosmetic private lawn and garden uses. In Ontario, over 250 chemical pesticides products were included in the ban. While these restrictions have substantially reduced the use of pesticides, they have also introduced the possibility for consumers to seek and use banned pesticides to address pest-control concerns.

Asia

Asia is a growing and dynamic region in terms of agricultural markets, and these markets also provide tempting incentives for unscrupulous operators. Many national and regional authorities are actively working to develop adequate legislation, production and product use controls, and oversight capacity and mechanisms for international cooperation regarding the governance of pesticides. Limited laboratory infrastructure, analysis capacities for pesticides and chemicals, lack of experienced and trained personnel and financial limitations constrain the development of effective chemical and pesticide quality control and oversight programmes in many parts of Asia (FAO-ROAP, 2012).

Regional efforts to eliminate highly hazardous pesticides, to improve pesticide registration and risk assessment, and to reduce fake, counterfeit and substandard pesticides are underway, although not all countries in the region consider illicit pesticides to be a serious problem (FAO, 2014). Most Asian countries do not conduct point of sale or field-testing for pesticides, another vulnerability exploited by organized crime and illegal actors.

In India, a manufacturer of pesticides for internal agricultural consumption and export, non-genuine and illegal pesticides are

increasingly recognized as a major economic, environmental and human health concern. More than 60 technical grade pesticides are manufactured in the country by 125 producers and more than 500 pesticide formulators operating throughout the country (PTI, 2014). Recent enforcement activities, media coverage and farmer protests have highlighted efforts to address the growing problem of illicit pesticides which is reported to affect up to one-third of the volume and one quarter of the value of the domestic pesticides industry - up to USD 525 million in 2013 (FICCI, 2015). The Parliament is currently considering pending regulation (Pesticide Management Bill 2008) to update its pesticide regulatory regime, penalties for violators and harmonization with international intellectual property standards.

Due to the size of their markets and roles as major producers and consumers of agricultural chemicals, Indian and Chinese efforts to control the unsafe and illicit pesticides trade are especially important. In China, these efforts include new legislation, guidelines and procedures to regulate the production and distribution of agro-chemicals under the auspices of the Institute for the Control of Agrochemicals, Ministry of Agriculture (ICAMA). Potential areas for greater attention include regulated quality control, implementation of relevant standards, management systems, information sharing on producers, certificate verification, sales testing and regular field monitoring (FAO-ROAP, 2012).

Eastern Europe, Caucasus, and Central Asia (EECCA)

EECCA[13] countries are characterized by uneven economic development, relatively low labor productivity, exodus of productive capital and educated citizens, combined with historically unsustainable exploitation of natural resources. Shadow economic activities, instability in governing institutions, and weaknesses in regulatory and enforcement systems have created significant challenges to sustainable growth of agricultural and industrial sectors, as well as integration with world commodities markets. Over the past several decades with assistance from international NGOs and partner countries, EECCA countries have made measurable strides towards addressing serious and pervasive economic and concomitant environmental issues.

Proximity to major pesticides producers and consumer markets for agricultural, chemical, and economic commodities, make these countries particularly at risk for the deprecating and corrosive effects of organized criminal activities. Risks related to illicit pesticides range from the reintroduction of obsolete pesticides stocks into agricultural production to the manufacture, assembly and distribution of illicit pesticides in country and for export.

Europe

European Union countries have among the most stringent and effective chemical control systems in the world, with corresponding regional and consumer interest in the quality, authenticity and

13. EECCA countries include Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

healthiness of food and agricultural products. As the world's largest importer of agricultural products, national governments and numerous institutions throughout the European Union are actively engaged in addressing the problem on multiple fronts. Despite these facts, the OECD, Europol and the European Commission report that illicit pesticides have been identified in almost every European country, and that 10% of the European market for pesticides may be comprised of parallel, unregistered, obsolete, fake or counterfeit products, with some individual country markets composed of 25% or more.

Large volume seaports are the most commonly identified entry points for illicit products into the market with considerable internal market movements in conjunction with misuse of the parallel trade system to insert illicit pesticides into legitimate distribution chains (European Commission, DG Santé, 2015). Delays with re-authorizations of plant protection products in terms of EU standards evaluation and the misuse of emergency authorizations contribute to confusion about the legality of certain products (European Commission FVO, 2015). Further, weaknesses in marketing controls (labeling checks and quality controls) reduce assurances about product authenticity and the detection of illicit pesticides (European Commission FVO, 2015).

Based on market size, product volumes, shipping methods, proximity and trade with non-EU regulated countries, and variations in regulatory development and enforcement efficacy among market members, the EU represents one of the most challenging markets in terms of the developed and complex networks for product distribution. These features, combined with the availability of research on the illicit pesticide market, also make it an excellent testing and proving ground for increased user and consumer awareness programmes, development of targeted risk-based monitoring procedures, expansion of international cooperation strategies, and improvement of enforcement capacities and mechanisms including enhanced penalties.

Oceania

In terms of landmass, agricultural production and pesticide consumption, Australia and New Zealand are the primary risk focal points for potentially illicit pesticides in Oceania. However, due to the fragile ecosystems of the largely island nations in the region, including Polynesia, Micronesia and Melanesia, much of Oceania is particularly susceptible to severe consequences from the misuse of legitimately registered and illicit pesticides.

In Australia, CropLife has estimated that illegal pesticides could account for 3% or more of the plant protection industry (Heard, 2013). Specific estimates are not available for New Zealand, although there are recorded incidents of online sales of illegal and banned pesticides (some fraudulently labeled as fertilizers) import and sales of unregistered and counterfeit chemicals, sales of repackaged pesticides (into smaller containers which were not labeled or improperly labeled), and distribution through couriers without required hazardous declarations and labeling (Peters, 2013).

Table 4.
Summary of illicit pesticide market dynamics, by region, 2016

Region	Illicit pesticide market dynamics
Africa	• Rapidly developing and growing export markets • Illicit pesticides may comprise 15-70% sales, depending on country • Lack of regulatory development and enforcement oversight • Limited analytic and laboratory infrastructure • Skilled personnel and financial constraints • Local preparations and refilled containers represent small but significant health risks
Americas	• Developed countries among top agricultural importers and exporters - Articulated regulatory controls - Internet sales represent risks at small scale commercial and individual consumer level • Developing countries have growing agricultural markets - Lack of regulatory development and enforcement oversight - Limited analytic and laboratory infrastructure - Skilled personnel and financial constraints
Asia	• Rapidly developing and growing agricultural markets • Major pesticide and component chemical export and import markets • Lack of regulatory development and enforcement oversight • Limited analytic and laboratory infrastructure • Skilled personnel and financial constraints • Engaged in extensive regional efforts to mitigate problems
EECCA	• Lack of regulatory development and enforcement oversight • Obsolete pesticide stocks • Incentives for organized criminal activities • Assembly and transit of illicit pesticides to established markets and FTZs
Europe	• World's largest agricultural product import and export market • Illicit pesticides may comprise 10% to up to 25% of market in some countries • Highly regulated market with developed enforcement capacity in many countries • Parallel, obsolete and banned pesticides represent pervasive risk
Oceania	• Largest countries have growing export markets • Island and maritime ecosystems are particularly susceptible to illicit pesticide harms

Supply chain vulnerabilities, protection and resilience

Specific characteristics of the infrastructure, practices and operations of elements of global supply chains contribute to risks associated with illicit products, including pesticides. A range of threats to plant protect product authenticity, ingredient and label integrity can occur at numerous stages during the pesticide life cycle within supply chain networks.

In terms of agricultural and food supply networks, three operational level principles are essential to product integrity, safety and quality control - visibility, authentication, and traceability. Visibility refers to the availability and usefulness of information regarding the origins, status, location, or conditions (e.g., temperature, volatility) of a product or particular shipment. Authentication confirms that a product originated from a genuine manufacturer or is genetically or chemically as identified and presented. Depending on the product, authentication may occur at critical junctures, or choke points, during the manufacturing process, or continuously through processing and distribution steps where authenticity may be compromised. Traceability capabilities extend the basic concept of visibility throughout the entire production and distribution process within and throughout the supply chain, from initial product components to ultimate distribution points and end users.

Technology plays a central role in the capacity and capabilities necessary to generate accurate, timely, and actionable information about illicit pesticides, as well as in authenticating and identifying registered and illicit pesticides. With interdiction and prevention as primary goals, the speed of incident detection, forensic investigations, and product intervention or removal to prevent future injury are critical. Systematic and continuous use of procedures, technology, and auditing are necessary to identify high-risk shipments for potential illicit pesticides and contaminants at the earliest stages in the pesticide lifecycle, and to rapidly trace the production source.

A number of technologies may be used to authenticate products, including packaging techniques such as holograms, barcodes, and radio frequency chips. Immunoassay and chemical tests may also be used to detect active ingredient concentrations and contaminants. Historically, these types of tests have been expensive, although technological advances and market demand are beginning to make them more affordable and accessible. Authentication efforts are complicated by the volume of products that a legitimate company may produce and the availability of affordable standard assays or suitable laboratory and field tests to detect unauthorized ingredients. Some authentication measures can facilitate visibility and serve functional traceability purposes within the supply chain. Increasingly sophisticated detection and monitoring systems are heavily reliant on technologies.

Due to the expense and effort required to realize them, technological

investment must be leveraged by integration with other operational level processes and functions, such as quality assurance and product authentication, without introducing undue delays or disruptions in production or processing. Technologies are a powerful tool to address supply chain and security management issues related to assurance of legitimate supply chain trade, but cannot provide a stand-alone security solution. Tackling the problem of illicit pesticides will require on-going investment, employee, enforcement and farmer training, and managerial oversight for industrial sectors and regulatory systems, coupled with the capacity and flexibility to recognize and to adapt to the dynamic ability of illicit operators to quickly change activities and transshipment patterns in response to prevention strategies and product interdictions.

These factors suggest the importance of government and regulatory leadership through mandates and established authentication, certification, track-and-trace, and documentation standards in terms of promulgating and enforcing procedures and technologies to ensure regulatory compliance and business incentives. In a rapidly evolving global economy, based solely on resource capacity, large firms will be able to more easily develop and integrate responses to control illicit pesticides than small firms and small farmers. This is especially true in terms of regulatory compliance and enhanced security measures. Implementing or upgrading safety and security procedures present significant financial and resource burdens to smaller companies with smaller operating budgets and lower cash reserves. Regulatory schemes must recognize and make provisions to support small producers in these efforts.

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III. CONTROLLING ILLICIT PESTICIDE MARKETS AND ACTORS IN THE TRADE. RECOMMENDATIONS

Proliferation of illicit pesticides presents a range of threats to human health and safety and environmental systems that support human, animal, plant and aquatic life. Illicit pesticides also present significant threats and challenges to agricultural markets, legitimate producers and distributors, farmers and the agricultural commodity consumers that comprise a vast web of production and consumption linked through global agricultural supply chain networks. The wide range of products and activities that constitute illicit pesticides markets generate enormous obstacles in terms of standardized legal definitions, generating the necessary urgency and focus on prevention and interdiction, and raising end-consumer awareness of the potential hazards associated with illicit plant protection products. These issues and gaps create tremendous opportunities for organized criminal networks and actors to exploit growing agricultural markets.

Complex and variable systems of voluntary and regulated domestic and international product standards, processing capacities, and labeling characterize the international trade in agricultural commodities and food products. Members of regulatory, agricultural production, consumer communities, and extended market and supply chain networks have vested interests to reduce opportunities for illicit pesticides to enter agricultural markets, and to quickly identify, remove and punish responsible actors in order to minimize potential negative health, environmental and market impacts. Regulators, industry and professional associations, industry service providers, supply chain operators, farmers, consumer advocates, and health and safety professionals must work together to address the serious and growing challenges presented by the illicit trade in agro-chemicals and pesticides.

Effective formal and informal social control mechanisms in regulatory, production and supply chain networks are necessary to deter and mitigate potential disruptions and negative impacts from the use of illicit pesticides. As pesticide and illicit pesticide markets are large, growing and present numerous health, environmental, and economic hazards, members of these networks must become highly motivated to constructively engage in reducing opportunities for the production and distribution of illicit pesticides and in punishing criminal participants.

A comprehensive, harmonized and more effective approach to the

numerous risks related to the manufacture, shipment, distribution and use of illicit pesticides aligns into six (6) general areas (summarized in *Table 5*). These include:

1) Awareness and engagement of authorities and stakeholders;

2) International harmonization and regulatory oversight;

3) Supply chain protection and defense activities;

4) Enhanced investigation and interdiction capacities;

5) Control of financial flows and incentives; and

6) End-user and consumer awareness.

1. Awareness and engagement of (national, regional and local) authorities and stakeholders

The lack of comparative information on illicit pesticide markets, actors, and modus operandi presents an important opportunity for collaborative research by UNICRI, Europol, Interpol, the International Chamber of Commerce (ICC), OECD, United Nations Environmental Programme (UNEP), the World Customs Organization (WCO) and related inter- and non-governmental stakeholders. Such research should clarify the problem and the risks of illicit pesticides to better support effective prevention and control programmes to mitigate their impact. An improved understanding and assessment of the economic, environmental and social costs of illicit pesticide use is necessary to promote the development of more effective policy and practices for the control of illicit pesticides.

This research should include the collection and integration of existing and specialized surveys, data from private companies and specialized databases, and quantification of a variety of costs, including analytic techniques and facilities for chemical analysis and determination of residues in crop, soil and water, the monitoring and treatment of

poisoning incidences, as well as those of enforcement, seizure, storage and destruction of illicit pesticides. Addressing the lack of information and awareness of illicit pesticide impacts on a global and regional level will promote cross-national and regional integration and information-sharing across the broadest possible range of multi-lateral, multi-sectoral stakeholders to reduce the threats to human health and agriculture posed by illicit pesticides. It will also serve to clarify the roles and responsibilities of the multiple national authorities and ministries engaged with specific aspects of the problem of illicit pesticides, and facilitate the development of public-private partnerships to address the complex array of health, safety and environmental impacts.

2. International harmonization and regulatory oversight

Multilateral cooperation to successfully reduce the threat from illicit pesticides must be supported by harmonized and accessible registration and verification processes and procedures. Since 1966, the Codex Alimentarius on Pesticide Residues has provided the basis for international standards for residue MRLs in foods[14]. The Basel, Rotterdam, Stockholm and International Plant Protection Conventions provide instruments with direct operational implications for pesticide management. Numerous other instruments provide policy context[15]. Harmonization of norms, registration requirements, procedures and international cooperation in accordance with these instruments enable countries to work together more effectively, sharing resources, coordinating efforts, reducing duplication and streamlining review processes and oversight for ingredient and pesticide registration.

Lifecycle approaches to agricultural and health hazards inform a holistic and realistic approach to crop growth and pesticide management. International norms, standards guidelines and good practices regarding the use of pesticides have been developed over the last 30 years by numerous entities, including FAO, WHO, OECD, Strategic Approach to International Chemicals Management (SAICM), and Inter-Organization Programme for the Sound Management of Chemicals (IOMC)[16], culminating in the *International Code of Conduct on Pesticide Management* which incorporates the principles of Integrated Pest Management[17], the Integrated Vector Management, and risk management, as well as chemical, safety and health professional standards and best practices. The *International Code*, and Good Agricultural and Manufacturing Practices (GAP and GMP respectively) reflect iterative ongoing processes of awareness, education, and training about safe farm production and pesticide management procedures for producers (and indirectly consumers). These conjointly designed and continuously improving practices reflect regular, meaningful communication by regulators and industry producers with stakeholders and at-risk groups and result in improved outcomes that address emerging issues and challenges related to economic development and threats to human and environmental health.

14. Some countries have established additional and supplementary MRLs for specific crops and to address local market and consumer concerns.

15. These include the Montreal Protocol on Substances that Deplete the Ozone Layer, Convention concerning Safety and Health in Agriculture, Convention concerning Safety in the Use of Chemicals at Work, Convention concerning the prohibition and immediate action for the elimination of the worst forms of child labour, Rio Declaration on Environment and Development, Agenda 21 – Global Programme of Action on Sustainable Development, Convention on Biological Diversity, Convention concerning the Prevention of Major Industrial Accidents, and Strategic Approach to International Chemicals Management, adopted in 2006 by the International Conference on Chemicals Management (FAO & WHO, 2014).

16. IOMC is a consortium representing the FAO, the International Labour Organization (ILO), the OECD, the United Nations Development Programme (UNDP), UNEP, the United Nations Institute for Training and Research (UNITAR), the World Heatlh Organization/the World Health Organization Pesticide Evaluation Scheme (WHO/WHOPES), and the World Bank. More information are available at: http://www.who.int/iomc/en/

17. Integrated pest management is a holistic and sustainable crop management process that uses all available pest management strategies to prevent, avoid, minimize and suppress pest damage by the most economical and least hazardous means using an understanding of pest life cycles and a combination of progressively intensive biological, habitat, cultural, mechanical, physical and chemical controls as necessary.

Similarly, illicit pesticide control requires a lifecycle approach in ongoing and cooperative efforts from all stakeholders. Timely, consistent and harmonized registration procedures serve to reduce confusion over the legal status of thousands of types of pesticides within individual markets, thereby reducing opportunities for transnational and regional trade in illicit pesticides. Enhanced information-sharing and reporting through access to online registration systems will allow more rapid identification and interdiction of illicit products. Improved legislation that more precisely delineates offenses related to illicit pesticides, removes loopholes related to technicalities exploited by illicit actors. Enhanced penalties for related offenses will facilitate more serious and appropriate punishments and may provide a measure of deterrence for some potential participants in the lucrative trade. Promising legal techniques for the control of illicit goods include asset forfeiture, seizures of illicit goods under smuggling statutes rather than IPR violations, and attributing to shippers and distributors the costs of toxic and hazardous waste disposal for seized illicit pesticides.

3. Supply chain protection and defense activities

Awareness, accountability, and transparency in pesticides markets are essential for product assurance and safety. Awareness combined with proactive enforcement (detection, investigation and interdiction) are two of the most critical factors in undermining the use of and markets for illicit pesticides. With concerted efforts, it is possible to reduce specific and identifiable risks from illicit pesticides through systematic applications of risk management principles, technology and good manufacturing and management practices.

Regulatory agencies frequently rely on voluntary agreements with and within industries, as opposed to legal requirements, to manage pesticide, and this approach has promise with respect to other actors involved in the pesticides supply chain. Key focal areas involve enhancing incentives for best practices in the shipping industry, including container and supply chain control, and promoting penalties for failure to regularly monitor and control the brokers and products that constitute a small, but profitable, segment of their businesses. Verification of the authenticity of products and suppliers can be partially accomplished through the efforts of supply chain shippers and distributors to continuously improve legitimacy of participants and products in the global agricultural product supply chain. Regulatory agencies may also consider establishing requirements and standards for certification procedures and authentication technologies to promote and standardize authentication and track-and-trace systems for pesticides.

Shipping company and industry agent certification as well as registration oversight mechanisms such as Know your Customer and Know your Supplier programmes constitute due diligence activities that

enhance the overall integrity of participants and products within the supply chain networks. These efforts, combined with pesticide producer efforts to enhance product integrity and assurance through packaging and product authentication techniques with farmer consumers, serve to increase the difficulties of criminal actors and organized criminal groups to infiltrate legitimate supply chains.

Corporate social responsibility activities are another important mechanism for industries to engage in self-enforcement of accepted international or professional standards, including visibility and traceability of precursors and agro-chemical products. Industry-initiated voluntary activities involve improved production controls, record-keeping and labeling standards as well as industry sponsored educational programmes for law enforcement and end-product users regarding appropriate use and application techniques. Enhanced self-enforced industry practices can forestall additional expensive and cumbersome regulations, delays in shipping and transit, increase profitability by reducing liability and enhanced scrutiny, and improve investor and customer satisfaction with the credibility and transparency of business practices.

4. Enhanced investigation and interdiction capacities

A variety of strategies are necessary for efficient and effective enforcement oversight of registered pesticides, as well as the interdiction and destruction of illicit pesticides. Capabilities and abilities of law enforcement agencies, customs, port and agricultural, food and veterinary inspection authorities to verify suppliers and products are critical elements of an effective system of illicit pesticide controls. Enhanced cooperation between customs and law enforcement would serve to address the lack and gaps in intelligence that make effective enforcement possible. An important component of enhanced investigations and interdiction is risk assessment modeling, a multi-step process that involves identification, analysis, evaluation and prioritization of specific characteristics and elements of the trade in illicit pesticides as well as the geographic, situational and agency capacity dynamics to determine and adjust specific criteria for risk indicators.

Cultivation of actionable information on illicit pesticides and related financial flows will require both commercial and law enforcement involvement, and include real-time monitoring, risk-based audits and inspections, investigations and reviews of specific producer and distributor activities based on the identification and recognition of the characteristics of local markets. Market studies and surveys of activities and patterns of producers, broker, and distributors must be closely considered, scrutinized, and shared by and amongst enforcement agencies, industry, farmers and consumers to reduce risks from dangerous products and to deter participation of actors in illicit markets.

Information-sharing between national authorities, customs and law enforcement agencies is necessary to pursue an effective and comprehensive programme of risk-based or targeted inspections and interdictions. Tangible intelligence resulting from this cooperation, combined with harmonization of laws, can promote more uniform establishment and enforcement of criminal offenses necessary to deter and interdict illicit products and punish their producers, suppliers and distributors.

Existing Forums and networks, such as Eurojust, European Network for Prosecutors for the Environment (ENPE), and European Forum of Judges for the Environment (EUFJE) at the European level and International Association of Prosecutors (IAP) at international level, could serve as important platforms to facilitate prosecution and exchange information.

Silver Axe operation

In December 2015, Europol announced the seizure of 190 tonnes of illicit pesticides and the detection of one hundred cases of infringement after a 12 day operation in November involving 350 inspections in major ports, airports and borders of seven countries (Andersen, 2015; Europol, 2015). The highly coordinated international effort featured collaboration of law enforcement agencies to exchange and analyze data, liaison with plant protection industry associations, and cooperation with private sector pesticide producers. This operation demonstrates both the necessary elements and tremendous potential for successful interdictions based on cooperative risk-based enforcement.

5. Control of financial flows and incentives

Incentives and financial flows must also be more tightly controlled to reduce the ease with which illicit operators and organized criminal networks can profit from regulatory gaps and oversight. Developing effective incentive reductions will require a better understanding of specific market drivers – from both the producer and consumer perspective, and ongoing engagement and exchange with a range of stakeholders to capitalize on this knowledge. Authentication and traceability of suppliers, shippers, and distributors will promote the ability of authorities and legitimate industry participants to identify and remove bad actors. In the case of internet sales, awareness and cooperation of Payment Service Providers is an important element in reducing criminal distribution of illicit pesticides and potentially hazardous substances. Applying principles and recommendations of the Financial Action Task Force (FATF), including promoting customer due diligence and record-keeping, will raise awareness and generate capacity-building to reduce opportunities and to enhance penalties for transactions involving illicit pesticides.

A more articulated understanding of product and profit flows, evidentiary support, investigatory skills and personnel is essential to more effective control of the trade in illicit pesticides, and must be developed through cooperative efforts between legitimate producers and distributors, regulatory and policy authorities, and enforcement agencies. Within countries, enhanced distribution and storage requirements and oversight can help to identify specific criminal actors and groups, reveal patterns and trends in illicit trade of pesticides, as well as to confiscate illicit goods and ill-gotten financial gains (BASCAP & UNICRI, 2013) with special attention directed toward distribution of online and internet-based sales of illicit pesticides. Focusing on the proceeds of crime and promoting the exchange of information and good practices in conjunction with international networks such as the Camden Assets Recovery Inter-Agency Network (CARIN) will contribute to the continual development of refined typologies that inform more risk-based controls of financial incentives derived from illicit pesticides. These efforts will lead to more effective techniques of investigation and interdiction, ultimately resulting in the reduction or removal of incentives and profits of criminal actors and organizations involved in the trade.

6. End-user and consumer awareness

Finally, end-users must better understand and adopt effective pest management techniques and processes. Without knowledge of the potentially severe consequences posed by illicit pesticides to crops, markets, health of agricultural workers and the ecosystems that sustain them, unsuspecting farmers and end-users may fall victim to these threats. Lack of awareness of the harms of illicit pesticides and sensitivity to costs differences in legal and illicit products create and amplify significant health and economic costs and risks for the farmers, communities and markets that their labors create and support.

Risk communications through national and competent authorities, cooperatives and farmer education programmes should provide timely, accurate information and promote Integrated Pest Management practices, including the appropriately limited use of registered, approved pesticide products. Farmer and agricultural worker-led initiatives to educate potential users about illicit pesticides should especially be supported due to the effectiveness of network-based and peer-to-peer communications in changing undesirable and dangerous behaviors (BASCAP, 2009). Additionally, international and regional authorities, along with agricultural and veterinary authorities, health authorities, and legitimate pesticide producers, must provide mechanisms for farmer consumer and public reporting of the use and impact of illicit pesticides.

Table 5. Integrated illicit pesticide management activities

Control Points	Activities	Target Audience
Awareness and engagement of authorities and stakeholders	• Research for better understanding of problem and impacts • Cross-national and regional information sharing on illicit pesticides, organized crime groups, and effective control techniques • Multilateral, multi-sectoral cooperation • Clarify roles and responsibilities of multiple ministries • Public-private partnerships • Memorandums of Understanding • Voluntary partnership agreements (VPA)	• International and regional organizations • Law enforcement agencies • Prosecutors • Judiciary • Legislators • Customs and port authorities • Agricultural and veterinary (enforcement and outreach) authorities • Farm cooperatives
International harmonization and regulatory oversight	• Timely, harmonized registration procedures regionally and internationally • FAO Pesticide Registration Toolkit • Improve legislation and increase penalties • Enhanced reporting and information sharing through universal access to online registration systems	• International and regional organizations • National regulatory authorities • Non-governmental and civil society organizations
Supply chain protection and defense activities	• Agent Certification, Registration oversight • Due diligence, KYS, KYC programmes • Manufacturer design, packaging and labeling improvements and innovations • Precursor/Product integrity and assurance • Precursor/Product tracking/traceability • Expanded liability for uncontrolled products • Enhanced financial measures (controls) regarding illicit products (e.g., paying costs of storage and destruction) • Distributor facilities and sales records inspections • Container management programmes • Reduced opportunities for participation of criminal actors and organized crime groups	• Legitimate manufacturers and producers • Legitimate distributors • Shippers • Farmers • Farm cooperatives

Enhanced investigation and interdiction capacities	• Cultivation of actionable information on financial flows and evidence • Risk monitoring and high value targeting • Risk-based inspections • Market surveys • Improved testing technologies • Directed and random sampling and residue monitoring programmes • Clarify roles and responsibilities of multiple authorities • Improved collaboration • Improved information sharing between national authorities, customs and law enforcement agencies • Focused investigations on the role of organized crime	• Law enforcement agencies • Customs and port authorities • Agricultural and veterinary (enforcement) authorities • Legitimate producers
Control of financial flows and incentives	• Authentication and traceability of suppliers, shippers and distributors • Enhanced penalties • Confiscation and asset forfeiture • Enhanced storage requirements and inspections • Controlled deliveries and storage • Monitoring unauthorized distribution and sales • Financial investigations into involvement of organized crime groups	• Law enforcement agencies • Agricultural and veterinary (enforcement) authorities • Legitimate producers • Shippers • Legitimate distributors
End-user and consumer awareness	• Risk communications • Information bulletins • Cooperative, association and farmer education programmes • Integrated Pest Management practices • Promotion of registered, approved products • Mechanisms for reporting	• Farmers • Farm cooperatives • Distributors • Agricultural communities

IV. UNICRI AND INTEGRATED ILLICIT PESTICIDE MANAGEMENT. A WAY FORWARD

Illicit pesticides generate a number of serious economic, environmental and health impacts, and undermines the influence of illicit pesticides on sustainable development, global stability and security as well as the pernicious influence on markets and ecosystems perpetrated through the involvement of organized criminal actors and networks. UNICRI has long-recognized the threats to development and security posed by the adaptability of organized crime and its infiltration into international trade, and therefore has worked diligently to strengthen the rule of law and institutional capabilities to address challenges related to organized crime and corruption. Since 1991, UNICRI has confronted the challenges from crimes against the environment and related emerging threats through applied research, awareness, law enforcement and prosecutorial capacity building and international cooperative initiatives.

UNICRI has and will continue to take an active role in addressing and facilitating research, training and technical assistance, and capacity building directed toward controlling facilitators of and criminal actors and networks that profit from illicit pesticide markets. This research and the Workshop organized in October 2015 in Turin, Italy, are showing UNICRI's commitment to be engaged in an evidence-based approach aiming at understanding and disrupting market drivers, connectors, and actors involved in illicit pesticides markets.

UNICRI is dedicated to improve awareness and development of institutional capacities for enhanced cooperation and enforcement on illicit pesticides and organized crime through four (4) primary mechanisms:

1. **Data collection to support gap analysis and threat assessments;**
2. **Capacity building for law enforcement, prosecution, and judicial authorities;**
3. **National cooperation and coordination; and**
4. **International cooperation.**

1. Data collection to support gap analysis and threat assessments

UNICRI will provide data and analytic support, and serve as a consultative and cooperative platform on sensitive issues related to illicit pesticides, including programmatic developments related to information-sharing, training, and best practices. By facilitating and supporting gap analyses of existing policies and operational practices by regulatory, law enforcement agencies and pesticide users, UNICRI seeks to determine and promulgate the most effective strategies and tactical interventions to disrupt the trade and use of illicit pesticides. Results of these research efforts will include developing and sharing information about manufacturers, suppliers and distributors of illicit pesticides and the evolving methods, techniques and transit patterns used to evade detection. Analyses will further involve supporting international standards and capacity development, identification and timely sharing of relevant information, and formalization and sharing of good practices by a variety of stakeholders. Empowering national regulatory authorities to make informed decisions and policy choices regarding manufacturing, distribution, and interdiction strategies for illicit pesticides is essential to disrupt the growing markets for these products. UNICRI research and data analysis will produce specific threat assessments, thematic reports, national and regional SWOT (strengths, weaknesses, opportunities and threats) analyses, as well as contribute to the design and production of CONOPS (concept of operations) and national action plans.

2. Capacity building for law enforcement, prosecution and judicial authorities

UNICRI has significant experience in improving the ability of law enforcement, prosecutors and judges to pursue and secure convictions and penalties through a better understanding of the legal frameworks and the common tactics and modus operandi of illicit pesticide manufacturers and distributors. Without a clearer understanding of the legal context, liability of actors, the penalties related to illicit pesticides and the corresponding potential harmful consequences and impacts, authorities cannot respond appropriately and effectively to the investigative and legal challenges presented by illicit pesticides. A fundamental component of reducing the growth and impact of illicit pesticides involves education, awareness and capacity building through training and technical assistance of national authorities and regulators, supply chain participants, enforcement and inspections authorities, prosecutors and judicial authorities in terms of improving inspection methods and techniques, enhancing risk and intelligence-led enforcement, strengthening prosecution and improving sentencing strategies and outcomes. UNICRI will conduct training needs assessments with national stakeholders, and use this information to design, develop and deliver multidisciplinary national and regional

capacity building workshops, seminars, trainings, and e-learning opportunities as well as requisite training materials, including manuals and toolkits.

3. National cooperation and coordination

UNICRI has distinctive and specialized abilities to cultivate national cooperation among regulators, customs and law enforcement, prosecutors and judicial authorities. Concerted and coordinated efforts by multiple agencies are necessary to control illicit pesticide markets and actors involved in the trade. Task forces and working groups are effective mechanisms to identify and address significant and complex issues. They can generate multi-agency coordination, shared resources and communications necessary to engage effectively with the multifaceted challenges involved in the detection, investigation and prosecution of illicit pesticides. UNICRI involvement will generate an analytic framework to promote the development of cooperative justice system mechanisms, such as working groups and task forces, to address investigations and legal processing issues related to illicit pesticides. UNICRI will aslo conduct an assessment of the impact of multi-party engagement and collaborative mechanisms on illicit pesticides trade within and across countries.

4. International cooperation

UNICRI will actively support cooperation of multi-country, regional organizations, stakeholders and experts to develop data-driven programmes through enhanced communication efforts necessary to identify and promote effective collaboration across and within national borders. Recognizing the supranational characteristics of illicit pesticide production, distribution, and use, UNICRI understands that a comprehensive approach is essential to better exert control over the illicit pesticide trade, in its many forms, and the criminal actors and networks that participate in illicit pesticides markets. To address the complexities of the interrelated regulatory, enforcement and inspection, and risk profiling activities, UNICRI is committed to support illicit pesticide trade control efforts in both origin and destination countries in different regions on issues of mutual interest through a number of activities, including meetings and workshops, participation in international and regional task forces, and stakeholder technical assistance, training and capacity building. UNICRI support for collaborative efforts will inform the development of an analytic framework to promote national, regional and international cooperation in addition to the identification, testing, monitoring and evaluation of specific cross-national and intra-national collaboration mechanisms.

Priority measures and concrete actions to develop and promote integrated illicit pesticide trade control activities have been identified

and discussed throughout this paper. Following the process started with the Expert Workshop, UNICRI will take an active role in the development and adoption of these measures, ensuring the participation of international, regional, national and local stakeholders to prevent and reduce opportunities and markets for illicit pesticides, increase the application of penalties for those involved in the trade, and to ensure the quality, authenticity and safety of agricultural inputs and food products.

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ANNEX 1. SELECTED INCIDENTS OF INTERDICTED ILLICIT PESTICIDES

Country/ Countries	Year	Details	Source
Belgium	n.d.	Detection of presence of products authorized in other European Union countries but not authorized in Belgium. There was no danger to public health. Products were seized and destroyed.	OECD Survey, 2012
Belgium, France, Germany, Italy, Slovenia, Spain, and The Netherlands	2015	350 inspections at major ports, airports and borders resulted in the confiscation of 190 tonnes of illegal and counterfeit pesticides. The inspections were conducted as part of a 12 day internationally coordinated enforcement effort in November 2015 that featured shared data and analysis, liaison with plant protection industry associations, and cooperation with pesticide industry producers.	Andersen, 2015; Europol, 2015
Canada	2006	Unregistered Glyphosate from China was imported and resold for personal profit. The Pest Management Regulatory Agency became aware of this illegal activity from industry complaints. The importer admitted to the import and resale, including to a retailer. The product was detained. A Compliance Order was issued ordering the return of this product to the original distributor in China and three Notices of Violation with Penalty for the import and sale of an unregistered product were issued. The importer paid the monetary fines, but did not take the required steps to dispose of the illegal product as defined in the compliance order. After lengthy correspondence with the importer, preparations were made to confiscate the product and arrange for its disposal. Before PMRA could confiscate the product, the importer reported it as stolen from the storage facility. The entire investigation was turned over to the police. International counterparts were notified.	OECD Survey, 2012

China	2014	A Chinese court has sentenced 6 companies to almost USD 26 million fines for discharging waste acid (pesticides, herbicides, and fertilizers) into two waterways.	http://www.nytimes.com
China	2012	33,000 tonnes of counterfeit seeds, pesticides, and other materials seized.	http://neurope.eu
China	2010	Successful enforcement of law prohibiting sale of counterfeits, resulted in 1 year in prison for the supplier and compensatory damages of $6,215 to the farmer whose crops were damaged by the illicit product.	Matthews, 2010
China	1995	500 students become ill after consuming food with illegal pesticides.	ECPA, 2008
Denmark	2007	Danish Tax and Customs Authority completed a 2 years investigation into illegal import of pesticides from Germany, triggered when customs discovered truck of illegal products trying to enter country. Denmark fined 87 farmers for illegal import and failure to pay Danish pesticide duty, about 250 million Euros total as well as fines for VAT fraud.	ECPA, 2008
France	2005	Discovery of parallel importing of patented active ingredient. Producers registered with French authorities, but broke 3 regulations – original packaging repacked (prohibited in France), trademark misused on packaging, and use-rate of product was higher than original label recommendation. Refilling of containers is of great concern to French authorities who are concerned about the impact of counterfeits in French agricultural markets. Registration was withdrawn. The product was widely available in the French market, although in unknown quantities.	ECPA, 2008
France, Italy, Spain	2004	Crop Destruction of fields (maize, potatoes, tomatoes) due to illegal pesticide.	ECPA, 2006
Germany	n.d.	Several incidents involving illegal imports of pesticides were discovered in Germany thanks to the information from customs offices, industry or consumers. In reaction, some permissions for the importation of PPPs were withdrawn and enforcement authorities imposed fines.	OECD Survey, 2012

Germany	n.d.	Granstar 75 WG was being imported under parallel import rules from Poland into Germany. It was repackaged and relabelled and significant amounts were sold in Germany. Lab tests showed a number of differences with the original products and the Lab concluded that during the repackaging unapproved materials were added, which constitutes an abuse of parallel import rules.	ECPA, 2008
Germany	2005	Illegal trade under guise of parallel trade. 50 tons of supposedly EU registered product were imported from a Polish broker. Parallel import was illegal, product was fake (copy or refilled containers) as documented by lab tests. 10 of 50 tonnes of the product were seized. The patent holder won the case, but received only small damage payments.	ECPA, 2008
Germany, Ukraine, United Kingdom (lower Saxony)	2002	Nitrofen's scandal. Nitrofen detected in Turkish food allegedly/referenced as "bio". Investigations and test revealed that the contamination was coming from a single source, a grain storage facility located in the North-East of Germany which was previously used a pesticide storage depot.	IERPC GAGER, 2003
Germany, Netherlands, Poland	n.d.	Import of highly toxic nicotine sulphate, unlicensed Daminozid were discovered in Hamburg. 19.4 tonnes of nic-sulfphate (declared as calcium cyanamide, aka lime nitrogen, a licensed fertilizer). Distribution to Germany, Netherlands, Poland. Additional imports from Belgium, China, India indicated through evidence of transshipment to Portugal, Spain, and the UK. Subsequent investigation into OCG indicated at least 1.2 million euro profit over two years.	German Bundeskriminalamt (BKA), Europol-OHIM, 2015
Ghana	2010	Banned and restricted pesticide stored near food stocks in farming areas are believed to have caused the deaths of 15 farmers.	Meeghan, 2013
Greece	n.d.	Major company took legal action against an importer selling illegal/fake herbicides for rice, obtaining a court order prohibiting sale of remaining stock. Administrative penalties of €10,000 and order of export to declared country of origin was imposed.	ECPA, 2008

Hungary	n.d.	A farmer was heavily fined for using illegally imported products. The crops were quarantined, and the farmer had to pay the analysis of his harvested crop to ensure that there were no residues.	ECPA, 2006
India	2015	Law enforcement arrested and charged Agricultural authorities in Punjab with criminal breach of trust and criminal conspiracy for serious irregularities in purchase of subsidized pesticides for distribution to farmers. The pesticides in question were implicated in significant cotton crop loss and have generated a farming and political crisis. Product purity varied between batches and cash was seized at the home of one official, allegedly taking money to renew contracts without proper bid tendering.	Gopal, 2015 and Haq, 2015
India	2015	Authorities raided warehouse and seized 170 drums of pesticide solvent imported from China. 22 brands of bio-products were mixed with pesticide chemicals from company licensed to sell crop micro-nutrients, along with packaging materials, labels, empty bottles and sealing machine. Charges included adulteration of bio-products, evasion of sales tax and violation of Trademark Act.	http://dnasyndication.com
India	2015	Authorities raided corporate office and two factories, seizing illegally imported pesticides that were not approved prior to importation, allegedly to evade taxes and perhaps rigorous approval procedures for substances.	http://www.thehindu.com, 2015
India	2013	23 school children died and more than 48 were hospitalized after eating pesticide-laden food, contaminated by oil stored in pesticide container.	http://www.theguardian.com, 2013
India	2011	Directorate of Internal revenue discovered illegal import to avoid 26% tariff.	http://www.livemint.com, 2011
Ireland	2013	Irish Department of Agriculture reported seizures and destruction of 8000 and 12000 litres of illegal pesticides – seized products re-enter marketplace. Regulation 608/2013 places responsibility for destruction and storage of counterfeit goods with the rights holder, the victim of IP infringement. (Europol-OHIM, 2015).	Europol-OHIM, 2015

Ireland	2008	Consignment of unregistered plant protection products was seized by pesticide control service as a result of industry complaints. As it was a first offense involving a substance with no negative health implications, distributor was allowed to return to supplier at company expense.	OECD Survey, 2012
Italy	2006	Wheat herbicide residue for organo-phosphorus insecticide methidathian detected (relabeling for price differentials with no concern for safety in terms of proper labeling/ use instructions).	ECPA, 2008
Italy	2006	Sample of herbicide Topik provided by anonymous source showed content to be another genuine product (Supracid). Removal of original Supracid labels and replacement with counterfeits allowed sale of Supracid (10 Euro) as Topik (100 Euro) with an estimated 1,000-2,000 litres sold.	ECPA, 2008
Italy	2006	Pesticide packaged like cooking oil.	ECPA, 2008
Japan	n.d.	Voluntary manufacturer report of misprints of expiry dates, container leaks and difference between registered content and label.	OECD Survey, 2012
Japan	n.d.	As a result of on-site inspection of an importer and distributor, material was determined to be an illegal unregistered pesticide product. In addition, there was concern about adverse effect of rotenone on fish. The related companies recalled the material from market. Authorities directed purchasers not to use the material, not to discard into river and to return it to the store.	OECD Survey, 2012
Moldova	2004 2015	Under the leadership of the Moldovan Ministry of Defense and with support from numerous international partners, Moldova is engaged in a comprehensive and costly programme to identify, consolidate, inventory and destroy extensive stocks of obsolete pesticides remaining from Soviet era agricultural practices.	Moldovan Ministry of Defense, 2015
Poland	2014	10.5 tonnes of unauthorized pesticides and 10.5 tonnes of insecticides in cans without labels, packed in brand boxes.	OLAF, 2014

Poland	2008	Raid in Lubaczow (35 km from Ukraine border) resulted in identification of 29/30 counterfeit samples, imported from China, over Poland-Ukraine border.	ECPA, 2008
Poland	2005	A product claimed to be legal parallel import of the same registered product was imported from Poland to the Czech Republic. Laboratory analysis showed impurities and the Czech authorities decided that it was in fact an illegal import and tried to remove it from the market. The owner company objected and despite clear indications that the product was illegally imported, it was allowed to be distributed, pending further action by the authorities. In 2005 the amount was estimated at about 14 tons.	ECPA, 2008
Russia	2008	The police raided premises near the city of Kursk, where around 100 tons of counterfeit and illegal pesticide products were found with an estimated market value of nearly USD 1 million. Most of the products were illegal copies of patented and branded products from major legitimate manufacturers pre-packed into containers ready for commercial sale. Adjacent to the warehouse, the police uncovered equipment designed to apply labels and stickers to the bottles, as well as other packaging equipment. Initial examination of the symbols on the seized product containers indicated that the products were manufactured in China.	BASCAP, 2015
Russia, Ukraine	n.d.	Russian OCG acts as a broker, ordering chemicals used in the production of pesticides from China. The chemicals are transported by container shipments and truck into Ukraine, where the pesticides are manufactured, labeled and packaged for further distribution across the EU.	Europol-OHIM, 2015
Russia, Ukraine	2005	Five farms reported sugar beet destruction from use of apparently illegal pesticides, with 5x75 hectares of crop loss. Investigations of putatively legal Caribou herbicide containers revealed them to be fake, although it was not possible to conclusively identify product.	ECPA, 2008

Scotland	2005, 2006	37 injunctions served on 20 Chinese companies and 2 stands at Glasgow Crop Science and Technology Exhibition. In 2006 exhibitors had to sign written agreement regarding authenticity of product, although that year, 24 companies were given injunctions (23 of them Chinese) with 2 ordered to close.	ECPA, 2008
Slovak Republic	n.d.	National inspection programme detected infringements for unauthorized product, unauthorized sale, labeling and content of active substance according to national law.	OECD Survey, 2012
Slovenia, Russia	n.d.	Russian OCG acts as agent for precursor chemical purchase for manufacturing pesticides, which were shipped in containers into Koper, Slovenia, then trucked to Ukraine – assembled, packaged, labeled and distributed. Similar established route to Hamburg and Rotterdam, diverted to Bremerhaven to avoid risk-profiling. Then Latvia/Lithuania to final destinations in Ukraine and Russia.	Europol-OHIM, 2015
Spain	2006, 2007	Use of isofephos methyl (illegal/unauthorized in EU) detected through import controls in another EU country, resulting in an alert through the RASFF. In December 2007, Seprona, the environmental police, made another seizure of over 2200 litres of mixed pesticides and arrested eleven people.	ECPA, 2008
Spain	2005	Spanish police dismantled OCG that may have introduced 150 tons of illegal pesticide into Spain over several years, an estimated 60 imports at 30 million Euro. Gang distributed to businessmen who sold to farmers cheaply. Discovered and reported by multinational corporations.	ECPA, 2008
Taiwan	2015	Indictment of man and daughter (Company X) for importing and selling over 417 tonnes of pesticide. China and India transshipments to Vietnam or Singapore to Taiwan labeled as legal imports from Vietnam. Estimated $570,000 profit. Owner had previously been found guilty in 2013 for fabricating pesticide labels and given a suspended sentence.	http://focustaiwan.tw, 2015
Tanzania	2012	Reported seizure of 5 tonnes Syngenta product.	Guyer and Davreux, 2012
Ukraine (Uzin)	2006	Seizure of over 500 tonnes of counterfeit products that were generic product from smuggled from China and repackaged. By law, products could be auctioned off if product did not pose threat.	ECPA, 2008

United Kingdom	2007	Court found importer guilty on three counts of illegal storing foreign pesticides. One, Carbaryl was banned in UK in 2001 following safety review. Another had significantly different concentration of active ingredient than any UK approved product. Importer got 2 years conditional discharges and ordered to pay prosecution costs in addition to his own legal costs.	ECPA, 2008
United Kingdom	2002	British residue study found 8 unapproved and potentially dangerous pesticides on foods.	ECPA, 2006
United Kingdom	n.d.	Sale of unapproved product reported by industry. Investigation identified counterfeit product that was seized and disposed.	OECD Survey, 2012
United Kingdom	n.d.	Competitor-reported sale of revoked product by 2 major companies. Product was recalled and exported.	OECD Survey, 2012
United States	2015	Labeling and independent testing indicated the use of pesticides not approved by the Colorado Department of Agriculture for use on medical and recreational cannabis. The US EPA has never established pesticide safety standards or limits as marijuana is illegal under US federal law.	Migoya and Baca, 2015
United States	n.d.	A company paid $1.4 million civil administrative penalty to EPA for importing selling and distributing seed that contained an unregistered genetically engineered pesticide. EPA also issued a Stop Sale, Use or Removal Order for all quantities of violative seed. Company disclosed possible distribution to US, EU and South America. USDA, Food and Drug Administration (FDA), and EPA investigated and evaluated confirmation of distribution over 100 times. Penalty also assessed by USDA, company destroyed seed under USDA supervision.	OECD Survey, 2012
United States	n.d.	Two companies manufacture, market and sell a variety of pesticide products. Through an administrative penalty case, these companies were penalized via settlement for violations of the Federal Insecticide, Fungicide, and Rodenticide Act. According to the terms of the settlement, Companies A and B collectively will pay a total civil penalty of more than $800,000, and will undertake corrective actions to ensure that the violations do not recur.	OECD Survey, 2012
United States	1985	Aldicarb (banned pesticide) detected in watermelon in California, resulted in over 1,375 reported illnesses and 17 hospitalizations.	U.S. Center for Disease Control, 1986


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