UNEP

CBD

CONVENTION ON BIOLOGICAL DIVERSITY

Distr.
GENERAL

UNEP/CBD/SBSTTA/6/7
20 December 2000

ORIGINAL: ENGLISH

SUBSIDIARY BODY ON SCIENTIFIC, TECHNICAL AND TECHNOLOGICAL ADVICE
Sixth meeting
Montreal, 12-16 March 2001
Item 4 of the provisional agenda*

INVASIVE ALIEN SPECIES

Comprehensive review on the efficiency and efficacy of existing measures for their prevention, early detection, eradication and control

Note by the Executive Secretary

Executive summary

The present note provides a summary of a comprehensive review on the efficiency and efficacy of existing measures for prevention, early detection, eradication and control of invasive alien species, in line with paragraph 15 of decision V/8 of the Conference of the Parties. It draws upon a number of background documents, and complements the progress report on matters identified in decision V/5, paragraphs 5, 11 and 14 (UNEP/CBD/SBSTTA/6/6) and the note by the Executive Secretary on options for future work (UNEP/CBD/SBSTTA/6/8).

Relevant international legal instruments have been developed under different multilateral processes for specific purposes. They include:

(a) *Multilateral environmental agreements*. These treaties reference alien species for their possible impacts on native species and ecosystems, but relatively little has been done to elaborate on general treaty obligations (with a few notable exceptions focused on Europe and Antarctica). Important components, notably early warning and monitoring and transboundary cooperation, tend to be covered only by generic provisions, and effective rules are lacking on liability and redress;

(b) *Sanitary and phytosanitary instruments* that control the introduction and spread of pests and diseases to protect human, animal and plant health, and have better developed provisions. However, the broader aims of the Convention on Biological Diversity are not adequately addressed by existing risk-assessment methodologies under these instruments, because biodiversity criteria are not included and data is lacking;

(c) *Technical guidance in the transport sector*. Non-binding guidelines have been developed by specialized agencies responsible for these sectors, notably to control invasive alien species

* UNEP/CBD/SBSTTA/6/1.

/…

introduced through ship's ballast water and civil aviation. However, these do not cover all pathways. Binding instruments are lacking, but the International Maritime Organization (IMO) is in the process of developing a legal instrument to control introduction of alien species through ballast water;

(d) *Instruments to regulate intentional introductions*, including the Cartagena Protocol on Biosafety, the FAO Code of Conduct for the Import and Release of Exotic Biological Control Agents , and the FAO Code of Conduct for Responsible Fisheries. The lack of binding instruments for aquatic introductions, other than of living modified organisms, is noteworthy.

There are gaps, overlaps and inconsistencies in existing instruments at all levels. Terminology is used differently in phytosanitary, transport and environmental sectors; moreover, conservation instruments often fail to define key terms and concepts. While existing legal instruments all require the prevention of unwanted introductions, most are weaker or silent on the question of eradication and control.

More generally, terrestrial systems are protected by measures developed for agricultural conditions, particularly for weeds and insects, some taxa such as nematodes, flatworms and snails are not well covered. Animal pathogens are well covered but only to the extent that the invading species is on the list of international notifiable diseases, so that gaps do exist for several taxa. Control of groups like birds or mammals is ineffective due to the limitation of tools or the restrictions from public concern. Aquatic systems are supported by fewer tools and capacities.

Gaps in prevention tools are arising from more stringent environmental controls on certain fumigants, pesticides and ship-hull anti-fouling agents. While many tools exist for early detection and eradication, for some taxa urgent work on new methods is required.

Generally throughout the world separate legal and institutional frameworks exist in each country for environment, agriculture, fisheries, international trade and other key sectors. Alien species tend to be tackled in a piecemeal way by different personnel for different objectives, under separate laws and regulations. This makes it difficult to implement a cross-cutting approach to the issue, and coordinating processes are needed at and between these levels and sectors to ensure sectoral consistency and more efficient use of available resources and tools.

Some cross-cutting areas are under-developed but offer potential for gains in efficiency and efficacy. These include improved integration and cooperation between sectors, institutions and countries; improved strategic planning on alien species issues; greater participation and engagement of stakeholders; review of incentive systems; and better use of existing generic environmental management tools and procedures.

Suggested action by SBSTTA and recommendations

SBSTTA may wish to review the note by the Executive Secretary and:

(a) Note gaps and inconsistencies among existing measures to address the threats of invasive alien species to biodiversity;

(b) Note relevant tools to address the threats of invasive alien species to biodiversity, including risk assessment procedures;

(c) Note existing terminology and compile a non-legally binding list of terms most commonly used.

Elements for draft recommendations to the Conference of the Parties are included in the note by the Executive Secretary on options for future work on invasive alien species (UNEP/CBD/SBSTTA/6/8).

CONTENTS

I. INTRODUCTION

1. Article 8(h) of the Convention on Biological Diversity requires Parties "as far as possible and as appropriate, [to] prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". At its fourth meeting, the Conference of the Parties, recognizing the problems alien species may cause to indigenous and local communities and negative effects on local and national economies, designated alien species to be a cross-cutting issue to be taken into account in each thematic work programme under the Convention, and decided that invasive alien species would be a matter for in-depth discussion of the sixth meeting of the Conference of the Parties. SBSTTA has developed Interim Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species ("Interim Guiding Principles") at the request of the Conference of the Parties.

2. At its fifth meeting, the Conference of the Parties, in paragraph 15 of decision V/8, requested the Executive Secretary, in collaboration with the Global Invasive Species Programme, the Food and Agriculture Organization of the United Nations, the International Maritime Organization, the World Health Organization and other relevant organizations and instruments to develop a paper for consideration by SBSTTA and the Conference of the Parties at its sixth meeting, including a comprehensive review on the efficiency and efficacy of existing measures for prevention, early detection, eradication and control of invasive alien species and their impacts.

3. The present paper has been prepared in response to that request and provides a synthesis of material provided in three more detailed papers, namely:

(a) Review of activities and programmes on prevention, early detection, eradication and control of invasive alien species (UNEP/CBD/SBSTTA/6/INF/3);

(b) Review of the efficiency and efficacy of existing legal instruments applicable to invasive alien species (UNEP/CBD/SBSTTA/6/INF/5);

(c) Report on procedures, criteria and capacities for assessing risk from invasive alien species (UNEP/CBD/SBSTTA/6/INF/6).

4. Section II addresses measures for the prevention and early detection of invasive alien species, including relevant legal instruments. Section III addresses measures for eradication and control of invasive alien species, and for mitigation of their impacts.

II. MEASURES FOR PREVENTION AND EARLY DETECTION OF INVASIVE ALIEN SPECIES

A. Generalities on introduction and prevention

5. Action to prevent or minimize introductions of unwanted alien organisms is almost universally preferred, due to the technical difficulties and costs of detecting, eradicating or containing introduced species that become invasive. All existing international instruments mandate prevention. However, they vary widely in the extent to which they provide indicators and criteria for practical implementation of prevention measures.

6. Alien species that are, or have a potential to be, invasive may be introduced into a country or area within a country by a number of vectors and pathways, including:

(a) Deliberate introduction of species for, *inter alia*, commercial or recreational purposes (e.g., fish for aquaculture; pasture species for rangelands; ornamental or other horticultural species)

(b) Deliberate introductions for bio-control purposes;

(c) Unintentional introductions of pests and diseases, and other species, through traded commodities, especially of agricultural produce, timber, livestock etc;

(d) Unintentional introductions of organisms through transport vectors such as shipping and aviation.

7. Prevention involves keeping the risk out of a country (or out of particular sites or areas within a country) or in quarantine at the port of entry. Measures for prevention may include:

(a) Controls on export of alien species or commodities that may harbour alien species;

(b) Controls on import of alien species or commodities that may harbour alien species;

(c) Controls on transport parthways such as shipping (ballast water and hull fouling) and aviation.

8. Tools for prevention include prohibitions and permits (especially for deliberate introductions), quarantine measures (especially for incidental introductions on commodities), and destruction of the unwanted species through biological control and physical or chemical means.

9. Such controls are transboundary by nature, and international cooperation is therefore vital. International instruments therefore play an important role in providing a generally accepted regulatory framework for national measures taken. Moreover, many measures have implications for international trade, and it is preferable, therefore, that measures are in accordance with multilaterally agreed standards. Other important tools for prevention include early detection and risk assessment. Further details of measures and tools are provided in information document UNEP/CBD/SBSTTA/6/INF/3.

B. International legal instruments that address the threat of invasive alien species

10. Many existing measures deal with alien species that may have undesired environmental or economic impacts. By the end of 2000, alien species were referred to in at least thirty-nine binding agreements and in a range of non-binding codes of conduct and technical guidelines. Most instruments are specific to a sector, taxonomic group, type of environment or type of harm.

11. Key instruments include the United Nations Convention on the Law of the Sea, the Convention on Biological Diversity, the Ramsar Convention on Wetlands and other multilateral environmental agreements, as well as instruments developed for the plant, animal and human health sectors, or to address particular vectors, such as the International Plant Protection Convention (IPPC) and instruments developed under the Office International des Epizooties (OIE) and specialized agencies such as the Food and Agriculture Organization of the United Nations (FAO), the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO) and the World Health Organisation (WHO). A comprehensive listing and description of relevant instruments are provided in the information notes circulated under this item on the review of the efficiency and efficacy of existing legal measures (UNEP/CBD/SBSTTA/6/INF/5) and the IUCN legal guide (UNEP/CBD/SBSTTA/6/INF/8).

Multilateral environment agreements

12. Prevention is treated inconsistently across existing MEAs. The level ranges from strong 1/ to weak. 2/ Most instruments provide no indicators of where prohibitions or restrictions should be imposed, unless their scope is limited to protected areas. No procedures are established for cooperation with countries that are the source/origin of alien species that may impact on biodiversity. The Convention on Trade in Endangered Species of Wild Fauna and Flora (CITES) is the only multilateral environmental agreement to mandate species-specific reciprocal controls between States of export and import. It would probably only apply to alien species introductions if a species protected in the exporting State was considered potentially invasive in the importing State. There are no criteria to promote consistent decision-making, other than broad references to "threat", "serious harm" or similar concepts

13. The Convention on Biological Diversity provides the most general provision, requiring Parties "as far as possible and as appropriate, [to] prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species" (Article 8(h)). The Convention contains no specific requirements of how this is to be done, though non-binding guidance is being developed (for example: the Interim Guiding Principles; and recommendations under various thematic programmes). A similar situation exists with other multilateral agreements.

14. More specific guidance has been developed under a few regional instruments. The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), developed under the Convention on Migratory Species, sets out detailed requirements for conservation actions including dealing with exotic species in its legally-binding action plan. Under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), the Standing Committee has adopted decisions on definitions, implementation and coordinated responses. The most comprehensive, legally binding measures are found in the Antarctic Treaty: the Madrid Protocol on Environmental Protection lays down stringent rules.

15. The Convention on the Law of the Sea requires Parties to take all measures necessary to prevent, reduce or control pollution of the marine environment resulting from the intentional or accidental introduction of alien or new species to a particular part of the marine environment, which may cause significant and harmful changes thereto (Article 196). Regionally, environmental protocols to four conventions developed under the UNEP regional seas programme contain specific requirements to prevent introductions to marine and coastal ecosystems (Eastern African region, Wider Caribbean region, South-East Pacific and Mediterranean).

Instruments to protect plant, animal and human health

16. Some of the earliest instruments that address the threats of invasive alien species aim to control the introduction and spread of pests and diseases in order to protect human, animal and plant health. For example, the IPPC provides a framework for international cooperation to secure common and effective action to prevent the introduction of pests of plants and plant products, and to promote appropriate measures for their control. The IPPC was revised in 1997 primarily in response to the adoption of the 1995 WTO Agreement on the Application of Sanitary and Phytosanitary Measures (the "SPS Agreement"). The IPPC trigger for pest classification is "injurious to plants or plant products". This wording covers alien organisms that could damage wild plants but not explicitly those that may harm ecosystem function or plant genetic diversity.

1/ Prohibition under AEWA and the Alpine Convention Protocol, strict control under the Convention on Migratory Species and the Bern Convention.

2/ The ASEAN Agreement, "endeavour to regulate, and where necessary, prohibit…".

17. The Office International des Epizooties develops standards and guidance on pests and diseases of animals (but not animals themselves as pests). Standards are set out in the International Animal Health Code for Mammals, Birds and Bees, including on import risk analysis and import/export procedures, and in the International Aquatic Animal Health Code, the aim of which is "to facilitate trade in aquatic animals and aquatic animal products".

18. The 1995 WTO Agreement on the Application of Sanitary and Phytosanitary Measures is relevant to alien species characterized as pests or diseases. A WTO member may adopt national measures to protect human, animal or plant health/life from risks arising from the entry, establishment or spread of pests, diseases, or disease-causing organisms and to "prevent or limit other damage" within its territory from these causes.

19. The 1969 WHO International Health Regulations, which were amended in 1973 and 1981, aim at ensuring the maximum security against the international spread of diseases. The goals are to: (i) detect, reduce or eliminate sources from which infection spreads; (ii) improve sanitation in and around ports and airports; and (iii) prevent dissemination of vectors. The Regulations are being revised and modernized to adapt to changes in disease epidemiology and control and to substantial increases in the volume of international traffic. These revisions will include modifications in notification and structural changes to require notification of any disease outbreak or "event of urgent international public health importance" (the present agreement requires the mandatory declaration of only cholera, plaque and yellow fever). The revisions are expected to be completed in 2002.

Instruments to address risks from transport

20. No binding standards apply to international transport, though some countries have moved ahead and adopted legislation in this area. IMO has adopted Guidelines for the Control and Management of Ships' Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens. 3/ The voluntary Guidelines are intended to assist Governments, ship masters, operators and owners, and port authorities to establish common procedures to minimize the risk of introducing harmful aquatic organisms and pathogens from ship's ballast water and associated sediments while protecting ship safety. In recognition of the limitations of the current voluntary guidelines, and the serious threats still posed by invasive marine species, IMO agreed in 1997 to develop a mandatory international regime to regulate and control ballast water.

21. The Cartagena Protocol on Biosafety includes provisions for handling, transport, packaging and identification (Article 18).

22. There are several gaps in the regulatory framework associated with transport. These include ship-associated vectors, not covered by the IMO guidelines, such as hull-fouling and anchor chains. Voluntary aviation-related standards do not go beyond civil aviation. Land transport is not formally regulated to minimize transfer risks. For inland waterways, there seems to be no guidance on water-borne transport or risks associated with canal links connecting drainage basins or coasts.

Provisions relating to intentional introductions

23. For intentional introductions, only three instruments mandate permit-type controls. The 1982 Convention on Nature Conservation and Landscape Protection requires Parties to prohibit the introduction of alien animal species into the wild without authorization from the competent national

3/ Annex to resolution A.868 (29), 20th IMO Assembly, 1997, which updates the 1993 IMO Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ships' Ballast Waters and Sediments Discharges (IMO Assembly Res. A.774 (18)).

authority, based on prior assessment of the consequences. The 1958 Convention on Fishing in the Danube prohibits the acclimatization and breeding of new fish species, other animals and aquatic plants without consent from the Commission established under the Convention. Under the Madrid Protocol, a permit is required for the introduction of any animal or plant species not native to the Antarctic Treaty Region: it may only be issued for species listed in an annex and must be subject to strict conditions for containment and eventual removal.

24. A major gap exists in relation to the introduction of alien species in to freshwater systems. The work programme on the biodiversity of inland waters under the Convention on Biological Diversity (decision IV/4) recommends that Parties should conduct inventories and impact assessments of alien species in such ecosystems and mitigate negative consequences of such species on inland water ecosystems especially at the watershed, catchment and river basin level. The FAO Code of Conduct for Responsible Fisheries provides some guidance, for example, for pre-introduction discussion with neighbouring States when non-indigenous stocks are to be introduced into transboundary aquatic ecosystems. It calls for harmful effects of non-indigenous and genetically altered stocks to be minimized especially where significant potential exists for spread into other states or country of origin. The Code proposes that States should collaborate in the elaboration, adoption and implementation of international codes of practice and procedures for introductions and transfers of aquatic organisms. However, there are no binding instruments on deliberate introductions. The International Watercourses Convention (which is not yet in force) sets in place measures for prevention of introductions of alien species to watercourses which could have adverse transboundary impacts.

25. The FAO Code of Conduct for the Import and Release of Exotic Biological Control Agents has been adopted as an international standard under the IPPC. It sets out internationally agreed procedures for agents capable of self-replication for research, for field release for biological control or for use as biological pesticides.

26. The Cartagena Protocol on Biosafety includes provisions for advance informed agreement by the receiving country for living modified organisms for intentional introduction into the environment (Articles 7–10). 4/

C. Standards for risk assessment

27. Risk assessment is an important activity to determine whether or not it is justified to carry out a certain measure, and, risk assessment is widely employed in the sectors of plant, animal and human health. With the increasing public demand for protection of the environment, there is a new drive to include broader criteria in the risk assessments conducted by national Governments.

28. There are no legally binding international guidelines for risk assessment of invasive alien species *per se*. Measures usually imply costs, whether the potential benefits forgone of not importing a commodity or species, or the direct costs of the measures themselves. Guidelines do exist for assessing the risk of introduction and spread of exotic animal disease and plant pests, including weeds. These guidelines were prepared over the past ten years, with the most recent addition being guidelines for aquatic animals. The Cartagena Protocol on Biosafety includes provisions for the management of risks posed by living modified organisms (Article 16), and includes a list of points to consider in risk assessment (Annex III).

29. For WTO members, national measures for prevention of alien species that may affect international trade must be consistent with WTO principles and rules, as expressed through the SPS Agreement. Where an international standard is set by an organization recognized under that Agreement,

4/ A simplified procedure applies for LMOs intended for direct use as food or feed, or for processing (Article 11).

States should base national measures on that standard. The SPS Agreement currently recognizes standards set by IPPC (pests of plants and plant health), OIE (pests and diseases of animals) and Codex Alimentarius Commission (food safety and human health). This excludes taxa that are pests in their own right but are not vectors of disease or injury to plants, plant products and animals. The mandates of the three organizations are broad enough to cover certain environmental and societal impacts, but no standards adopted to date take these dimensions adequately into account. However a working group under the IPPC is exploring the option of incorporating such environmental criteria into its standards for risk analysis.

30. Precautionary measures are advocated, required or allowed by several international instruments, including the Convention on Biological Diveristy, the Biosafety Protocol and the FAO Code of Conduct on Responsible Fisheries.

31. Reliable, consistent and comprehensive data is possibly the biggest challenge in the successful application of risk assessment to invasive alien species. This is particularly true for biological baseline data and economic impacts. These gaps exist both in the type and the quantity of data available, compared to what is required for comprehensive risk assessments to be undertaken. Lack of coordination in data collection programmes may provide data that cannot be used to form a comprehensive picture of the situation. Poor accessibility to information also hinders the majority of countries in their development of representative tools and procedures.

32. With animal health, the process of listing of notifiable diseases is not currently geared towards notification of broader environmental pathogens. However, once an animal disease is added to the list, there is an effective reporting system, recommended diagnostic techniques, and international networks on the topics.

33. In plant health, more guidance and much more implementation is needed in capturing the potential economic impacts of invasive species. In the implementation of the IPPC, currently there is a bias towards cultivated plants, and the potential to address other invasive species that impact on plants is not fulfilled. “New” pests that do not fall within the plant health mandate, such as flatworms that predate on native earthworms or poisonous spiders, may be left unregulated.

D. Prevention measures at national level

34. The use of import and export controls to prevent introduction of pests is long established. National plant and animal health services and customs authorities play a key role in implementation of border controls, import restrictions and other quarantine measures.

35. At the national level, most countries have at least a minimal system in place for regulating alien species introductions. Except for a few countries, these are rarely comprehensive and were not designed to conserve biodiversity against invasion impacts (except, possibly, in a limited way for protected areas).

36. Quarantine systems theoretically cover all introductions that can involve the transfer of pests, but in practice there are wide variations in the scope and administrative remit of national systems. Many countries face serious constraints on inspection facilities, taxonomic capacity, access to information, and human and financial resources.

37. Nationally quarantine and border control services are usually located in the ministry for agriculture, forestry and fisheries or equivalent. Under older sectoral legislation, officials may not have powers to detain species and consignments presenting risks to the natural environment but not to agriculture or forestry. Coordination between agencies is generally regarded as essential, yet few

countries have initiated coordination processes, though the number is growing, for instance New Zealand has adopted special legislation and created a Cabinet portfolio and dedicated biosecurity agencies.

38. Quite often, suitable tools are in place but under-used. Competent authorities usually have general powers under quarantine/agricultural legislation to adopt import/movement regulations for designated 'noxious weeds' and to require farmers and landowners to control such weeds. However, implementing regulations are not always issued promptly or publicized and applied.

39. Effective prevention also depends on restricting further imports and internal movements of alien species that present invasion risks: this is important to support containment strategies and prevent spread to other areas. This is potentially a gap under the IPPC whose provisions apply only where the species concerned is designated as a quarantine pest and thus subject to official control. Where an invasive alien species is not regulated as a plant pest by an individual country, IPPC provisions do not apply. The IPPC does provide for regulation of non-quarantine pests, 5/ but this concerns pests on propagative material and does not appear to support restrictions on pests with environmental impacts.

40. To strengthen prevention and mitigation, all sectors involved in alien species-related activities need to be appropriately engaged and accountable. However, contacts with vector-responsible groups seem to be under-developed, especially at international level. At the national level, a small but growing number of countries have developed contacts with vector-responsible groups. Australia and New Zealand show increasing cooperation between regulatory agencies and key sectors on the development or review of legal instruments and quarantine/import health standards. Voluntary codes of practice have been developed by some national nursery industries, sometimes facilitated by non-governmental organizations such as The Nature Conservancy.

E. Transboundary issues

41. Most multilateral environmental agreements do not specify State responsibilities towards neighbouring countries regarding alien species. Within most such agreements, there are references to the need for transboundary cooperation, including in Article 14, paragraph 1, of the Convention on Biological Diversity, which covers notification, consultation and emergency planning. There is a lack of specific agreed rules to be applied between countries, including on treatment of risk as it may affect another country. The Benelux Convention is the only treaty to mandate consultation with neighbouring States prior to intentional introductions (of alien plants). Bern Convention parties should inform Governments of neighbouring States if accidental introductions have occurred, and set up mechanisms for inter-State cooperation, notification and consultation in order to coordinate precautionary and control measures for invasive species. The Cartagena Protocol on Biosafety includes several provisions related to the transboundary movement.

42. Under the IPPC, pest risk analysis is used to justify national measures (in the absence of an international standard). However, there does not appear to be any requirement to analyse risk as it may affect another country (i.e. where a pest may have transboundary impacts), although the Convention does contain measures to prevent or limit the spread of pests between countries.

43. With regard to non-binding instruments, the FAO Code of Conduct for Responsible Fisheries recommends that States consult with neighbouring States, as appropriate, before introducing non-indigenous species into transboundary aquatic ecosystems. They should also make efforts to minimize the harmful effects of introducing non-native species into waters, especially where there is a significant

5/ Defined as "pests whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing party".

potential for the spread of species into waters under the jurisdiction of other States as well as waters under the jurisdiction of the State of origin.

44. Administrative boundaries can impede efficient action on invasive alien species. Coordination and harmonization are particularly important in federated or regionalized States where law-making and enforcement powers are shared between national and subnational governments. These are also key issues in the relationship between regional economic integration organizations and member States. Development and implementation of consistent rules is necessary to avoid situations where stringent measures adopted in one unit are undermined by weaker measures across a boundary.

F. Regional cooperation

45. Regionally cooperation is essential for effective frameworks, particularly where there are geographically and evolutionarily isolated ecosystems. Efficiency can be increased by sharing information, ensuring basic consistency in policies, legislation and practice and cooperating on risk analysis (e.g. of trade and transport pathways that concern several countries in the region) and eradication/control programmes.

46. Practical cooperation under regional environmental instruments is weak, except under the Bern Convention and the South Pacific Regional Environment Programme (SPREP). The SPREP Regional Invasive Species Strategy provides for a regional system of information collection and exchange as well as collaboration on preparation of black lists of invasive species. In the Mediterranean, the Barcelona Convention institutions and FAO have recently initiated cooperation on alien species issues: regional guidelines will be considered in 2001.

47. Under the framework of the IPPC, there are nine regional plant protection organizations (RPPOs), which vary widely in their operational capabilities. Several International Standards for Phytosanitary Measures (ISPMs) have been developed by RPPOs and presented for discussion at meetings of the Interim Committee on Phytosanitary Measures, generally because the topic was of urgent interest to that particular region. However, some RPPOs do not have the infrastructure to play an effective role in information collection or dissemination and discussion of International Standard for Phytosanitary Measures. The revised IPPC provides for regional economic integration organizations to become parties, which may facilitate regional input into the development of new standards.

G. Measures for early detection

48. The tools available for the early detection of invasive alien species include general surveillance or collation of information, site-specific surveys (for example, through trapping at likely entry points to ascertain the distribution of a known invasive or to detect a particular pest through trapping), monitoring, diagnosis by taxonomic identification, and public-awareness campaigns.

49. A significant developing tool is the use of information systems for regulatory purposes. While there is consensus on the need to enlarge databases on known and potential invasive species and to make this information accessible as part of global capacity-building on invasive alien species, it must be recognized that some kinds of information may have commercial or political repercussions, where it leads to refusal of certain commodities or species.

50. For most countries and ecosystems, there is no clear infrastructure for the early detection of invasive alien species. Monitoring schemes exist in several countries, particularly for crop pests. However, in many instances early detection depends on luck, and is reliant on workers on the ground (farmers, land managers), field naturalists (both amateur and professional) and members of the public.

Public-awareness schemes are widespread and, together with education and reporting mechanisms, can aid in the early detection of alien species.

51. No multilateral environmental agreements require monitoring of introduced species for impacts on biodiversity, though this has been addressed in recommendations adopted under some legal instruments: for example, Bern Convention Parties are recommended to monitor introduced populations of non-native terrestrial vertebrate species and assess the potential threat to biological diversity both within their territory and elsewhere.

52. IPPC, OIE and Codex Alimentarius support the establishment of surveillance systems as part of national frameworks and provide a basis for emergency action. Under the IPPC, elements should include identification of pests already present in a country and identification and surveillance of areas that are pest-free or from which a pest has been eradicated. In practice, national and regional capacity is critical to effective surveillance. It appears that few national plant protection organizations currently carry out regular surveillance because of the costs involved.

53. Within marine systems, there is currently no international system for the early detection of species introduced to new areas by ballast water. A few countries have instituted port biota surveys including Australia and the United Kingdom, and IMO is assisting six ports in developing countries and countries with economies in transition to carry out port surveys through the GloBallast programme. These are Brazil - Sepitiba, China - Dalian, India - Mumbai, Islamic Republic of Iran - Kharg Island, South Africa – Saldanha, and Ukraine - Odessa.

54. Nationally, monitoring and early warning systems are often weak. Common constraints include lack of information about species already present (baseline data) and lack of accessible information systems. Institutional fragmentation limits the ability of environment, veterinary, phytosanitary and health authorities to cooperate on prompt action. Some countries have no legal basis to conduct monitoring or control unless a species is first designated a pest. Relatively few attach monitoring conditions to permits or licences for containment/captivity of alien species. Emergency powers may be narrow and may not apply to biodiversity-related impacts.

H. Gaps in current measures, by ecosystem type, pathway and vector

55. Under international agreements, protection of species is weaker for lower taxonomic categories. Coverage of pathways and vectors for unintentional introductions is patchy and usually non-binding, notably for alien freshwater aquatic species.

56. While generally terrestrial systems are currently supported by measures developed under agricultural conditions, particularly for weeds and insects, some taxa are not well covered. Plant pathogens are not as well covered by the existing capacities and merit greater attention. There is a particular lack of awareness of some diseases and of certain taxa such as nematodes, flatworms and snails. Exceptions exist in special cases, such as island countries that have good monitoring programmes, often as the result of a devastating introduction in the past. Animal pathogens are well covered but only to the extent that the invading species is on the list of international notifiable diseases, so that gaps do exist for several taxa. Control of groups like birds or mammals is ineffective due to the limitation of tools or the restrictions from public concern. More methods for prevention and detection would be useful, particularly for reptilian and amphibian invasive alien species.

57. Aquatic systems are supported by fewer tools and capacities, although some key countries are making notable advances. Aquatic weed prevention and control has improved from public education and new technologies, but not yet in marine settings. The conflict between effective chemical and biological control for aquatic species (e.g., molluscs) and the desire for reduced pollution to these environments

seriously hampers control through the existing measures. Physical methods are still employed, but are only useful in contained areas. Most progress has been made with invasive fish species and aquatic animal pathogens. Guidelines and best practices now exist regarding introductions and transport of alien fish species. The recent inclusion of aquatic animal diseases (of fish, shrimp and others) among officially notifiable diseases will reduce the spread of pathogens to natural populations surrounding aquaculture or processing sites.

58. Gaps in prevention tools are being created by the elimination of fumigants and pesticides due to environmental concerns. This is particularly true for agricultural trade where certain chemicals are being phased out or banned because of health concerns as well as environmental objections. Currently no alternative treatments for a number of pest/commodity combinations exist when they are discovered upon arrival to the importing country. The same loss of a tool is true in marine systems, in which hull fouling is a major vector of maritime organisms along shipping routes. Traditionally, anti-foulant paint has been a means for control of hull fouling along with physical scrapping of the hull. The most effective active ingredient in antifoulant paint by far is Tributyltin (TBT). This chemical is being banned because of the environmental impact on non-target organisms by recommendation of the IMO Marine Environmental Protection Committee (MEPC).

I. Additional gaps

59. Consistent terminology may be considered a gap in a holistic approach to the invasive alien species issue. At present, there is no common glossary of relevant scientific terms and concepts for scientists, policy-makers and lawyers. Legal instruments at all levels use variable terminology, sometimes inconsistently or without adequate definitions. Different terms are used for alien species generally (non-indigenous, non-native, exotic, foreign, new) and for the subset that cause damage (pest, weed, harmful, injurious, invasive, environmentally dangerous). There are marked differences in use of terms in different sectors.

60. A further gap or inconsistency exists in the coverage of the various legal instruments (the action or process that should trigger application of legal measures). Some instruments take a narrow approach that only covers intentional introductions of alien species for release (possibly just to a protected area). This has the effect of excluding introductions for containment/captivity and translocations between different parts of the same country, both of which can present high risks of escapes. Options to address this issue are addressed in a separate note by the Executive Secretary (UNEP/CBD/SBSTTA/6/8).

III. MEASURES FOR ERADICATION AND CONTROL OF INVASIVE ALIEN SPECIES, AND FOR MITIGATION OF THEIR IMPACTS

61. Where an alien species has become invasive, options to prevent its establishment and spread include eradication (where feasible and cost-effective), containment or long-term control measures, and measures to mitigate the impacts of invasive alien species. A risk analysis is important to determine the type of measure to be taken.

A. Eradication: provisions in legal instruments

62. Multilateral environment agreements are also weaker or silent on the question of eradication and control. These matters are covered, however, by the Convention on Biological Diversity (Article 8(h)), the Convention on Migratory Species (Article III.4(c)), the 1992 Convention for the Conservation of the Biodiversity and the Protection of Wilderness Areas in Central America (Article 24)), and decision 7/14 of the Conference of the Parties to the Ramsar Convention. Multilateral environmental agreements do not usually distinguish “eradication” from “control” or provide guidance on implementation: this gap is most marked for the marine environment.

63. The Bern Convention is unique for its suite of recommendations on eradication/ control of named alien species. Its recommendation on alien terrestrial vertebrates (N0. 61, 1997) states that methods of eradication should be selective, ethical and without cruelty as far as possible, consistent with the aim of permanently eliminating the invasive species. It notes that feral animals of domestic species and commensal non-native species can be some of the most aggressive and damaging alien species to the natural environment, especially on islands. Parties were recommended to, *inter alia*, assess the feasibility of eradication populations representing a threat to biological diversity, to monitor effects of eradication on native fauna and flora, and to actively involve all interested parties.

64. Guidelines for pest eradication programmes were produced under the IPPC in 1998. These describe the components of a pest eradication programme that can lead to the establishment or re-establishment of pest absence in an area (see section III B below). The IUCN 2000 Guidelines for the prevention of biodiversity loss caused by invasive alien species also list several recommendations for successful, cost-effective and ethical eradications.

65. Environmental risk analysis of eradication/control techniques is not systematically referenced in existing instruments or guidance. However, the FAO Code for the Import and Release of Exotic Biological Control Agents recognizes that exotic biological control agents can have an adverse impact on ecosystems and other species and recommends the creation of emergency procedures to take action where an introduction goes wrong and has unintended environmental consequences.

66. National legislation is usually weaker on eradication and control than on prevention. Constraints are again linked to institutional fragmentation, narrow mandates and lack of a strategic framework for prioritized remedial action. More specifically, there may be legal and ethical obstacles to control measures for live animals and plants, as many modern conservation laws confer protection on all wild species without reference to native/alien criteria. This usually means that culling or control measures can only be carried out for species formally designated as “pests”, “noxious weeds” or “nuisance species”. Procedures for updating relevant regulations and species lists may be too slow to support rapid intervention.

B. Technical measures for eradication

67. The IPPC guidelines for pest eradication programmes list available methods for eradication include: host destruction; disinfestation of equipment and facilities; chemical pesticide treatment; biological pesticide treatment (e.g. bacterial spray); soil sterilants (e.g. heat treatment); leaving land fallow (crop rotation); suppressive soils (often after crop rotation); host-free periods; processing or consumption of infested crop (sanitation); the use of cultivars that suppress or eliminate pest populations; restriction of subsequent cropping; trapping; lures; shooting; inundative release of biocontrol agents; use of sterile insect release (SIR) technique; disruption of mating by releasing chemical sex attractants which confuse insects; antagonistic microorganisms (fungi); trap plants; interplanting of antagonistic crops; radiation; fumigation; disinfestation of warehouses using bleach.

68. A synergy that can be utilized is to ensure the technology that has been developed for sustainable agriculture is more broadly used across all environmental pests. Integrated pest management (IPM) technologies have been developed most strongly for the management of insect pest problems in agriculture. These technologies are frequently directed at a complex of pests that affect a particular crop system. Good progress has been made in implementation but uptake in the developing world is still relatively poor. Until recently, much of the effort was based on IPM for arthropods. Attempts are being made to develop IPM technologies for species in other taxa (e.g., mammals).

69. According to the IPPC guidelines, before eradication can take place, there must be effective surveillance to investigate the distribution of the pest, and containment to prevent the spread of the pest

In addition, there must be a good understanding of the biology of the target organism, and sufficient funding for training and follow-up measures to prevent re-invasion.

70. Eradication is more likely to be successful in the early stages of invasion. Even so, total eradication of an established alien species is often difficult to achieve. Most successful eradications have been on islands or from isolated populations, using a combination of methods.

C. Control measures

71. The aim of controlling invasive alien species has been either to contain the species within a geographical area or to suppress the overall abundance of the species down to some pre-described level where it no longer causes any significant economic, social or ecological damage. The threshold levels used have varied considerably according to the type of ecosystem being invaded (e.g. agricultural, "natural", etc.) and the nature of the invader; frequently, the threshold is not clear from a reported study but this will be discussed further below. Thus, overall, methods for the assessment of the efficacy and efficiency of the measures and tools used in these projects have also varied in relation to the particular 'systems' that have been targeted.

72. Sanitary and phytosanitary agreements often mandate zonation (OIE) and pest-free areas (IPPC) as part of broader requirements for pest containment/control. The 1997 revised IPPC provides for managed risk, pest free areas, consistent with the recognition of pest-free areas under the SPS Agreement. National plant protection organizations manage these identified pest-free areas and areas of low pest prevalence and undertake pest eradication from specific areas.

73. Control measures for either containment or suppression are similar to those for eradication and fall into the following categories:

(a) Physical or mechanical (e.g., mechanical harvesters, hunting, trapping);

(b) Chemical (e.g., herbicides, insecticides);

(c) Biological (this includes a number of tools: the introduction, conservation or augmention of natural enemies, the application of microorganisms as a biopesticide, host plant resistance (HPR), and other tools such as behaviour modifying chemicals (e.g. pheromones), male sterile release and fertility control);

(d) Habitat management (e.g. crop rotation, nutrient management);

(e) Integrated pest management, utilizing combinations of the above four main measures.

74. While many tools exist for early detection and eradication, urgent work on new methods is required for some taxa. Effective attractants do not exist for some species of particular concern. However, the major gap with many of these methods is that many countries, particularly in the developing world, do not have the technical knowledge, or the necessary infrastructures, or the policy support to be able to effect early detection and eradication programmes.

75. While capacity exists in control measures for some taxa, particularly for species that are a problem in the agriculture, forestry and livestock sectors, the same is not the case for all, and the capacity is not necessarily easily accessed by all countries.

76. Control efforts vary enormously in their efficacy, with successful control depending more on commitment and continuing diligence than on the efficacy of specific tools themselves.

77. A significant feature of all control measures, with the exception of 'introduction' (or 'classical') biological control, which is self-sustaining, is that they require long-term funding and commitment.

D. Mitigation of impacts

1. Mitigation and adaptation measures

78. The adverse impacts of invasive alien species are described in the annex to the present note. Strategies to control the impacts of established invasive alien species can include reduction or elimination of the invasive species and their spread through mitigation measures, such as eliminating the invasive alien species completely, containment (keeping the invasive alien species within regional barriers); or suppression (reducing population levels of the invasive alien species to an acceptable threshold), that would curtail the extent, duration and impacts of the invasion. Adaptation measures can also be taken involving changes in behaviour in order to reduce the impact of invasive species. The management objective should also specify the geographic areas for attention.

79. Attempts at predicting impacts have generally been unsatisfactory. There is a need for better and wider quantification and measurement of what invasive species do. In the context of preserving biodiversity, such studies are urgently needed. Data from countries where a species has previously invaded and been controlled can provide useful information on approaches to management. Control of impact would be most effective when it employs a long-term, ecosystem approach rather than an approach directed to controlling invasive species in isolation.

2. Restoration

80. Restoration can involve reintroduction or re-establishment of populations of native species and/or enhancement of native biodiversity and the structure and functions of the habitats or ecosystems that have been degraded as a result of invasion by alien species.

81. Restoration of native species, and habitat and ecosystem conditions, where feasible, can reduce the risk of future invasions in areas where control actions have reduced or eliminated invasive species. Without restoration, areas may become re-infested by the same or new invasive species.

82. Restoration techniques, based on detailed information on invasive species biology and ecology, site assessments (including, *inter alia*, hydrology and nutrient cycling) and with particular attention to site preparation, beneficial plantings and monitoring of the effects of disturbances such as fire and flooding, have allowed the recovery of some terrestrial habitats/ecosystems to nearly their states before invasions. Examples of success are few. Restoration of aquatic systems harmed by invasive species has proven more difficult.

83. There is a need to develop guidance for restoration. This could be based on existing restoration programs mandated by law (e.g., natural disasters, oil and chemical spills, and acid mine drainage) and include best practices for appropriate uses of native and desirable non-native species, the best available techniques for restoring habitats/ecosystems, as well as management practices that promote regeneration of native species and habitats/ecosystems

84. Many national laws subject reintroduction or re-establishment of native populations to the same rules as introductions or completely ignore them. In the latter case, reintroductions can only be regulated if the species is legally protected and its import, possession and transport controlled as it would be the case, for example, for species listed in CITES appendix 1. Legal frameworks should establish procedures and conditions for the assessment and control of reintroduction/re-establishment programmes. A checklist of suitable provisions, based largely on internationally agreed guidelines or recommendations is

given in the IUCN legal guide that is being circulated as information document UNEP/CBD/SBSTTA/6/INF/8. Some countries, such as the United States, are preparing draft legislation for control activities, including restoration, and tax incentives and other means to encourage participation of private landowners in these programmes.

Annex

ADVERSE IMPACTS OF INVASIVE ALIEN SPECIES 6/

85. Many ecologists consider alterations caused by invasive alien species to biological diversity as a threat second in impact to habitat destruction. This threat is growing daily with the accelerated rate of species' movements through trade, transport, travel and tourism. Their effects are exacerbated by global change, and chemical or physical disturbance to species and ecosystems. Invasive alien species are found in all taxa and all the thematic areas addressed by the Convention on Biological Diversity. Every alien species that becomes established in a new environment alters the composition of native biological communities in some way. These alterations can disturb the structure and functioning of the invaded ecosystem and have profound socio-economic impacts.

86. Addressing the impact of invasive alien species is urgent. A good knowledge and understanding of how alien species become harmful to ecosystems is a prerequisite for adequate mitigation and/or elimination of their adverse impacts. Loss and degradation of biodiversity due to invasive alien species can occur through species/population-level and habitat/ecosystem-level effects.

Species and population-level effects

87. Species and population-level effects include:

(a) *Elimination of vulnerable native species through predation, grazing, herbivory and competition for space or resources*. Elimination of native species has led to the extinction of some species, especially under island conditions (actual islands or ecological islands);

(b) *Hybridization between alien and related native species, including wild relatives*. Hybridization can threaten a native species even when the hybrids do not succeed, simply because crossbreeding reduce the number of new offspring added to the species' own population. Hybridization can also produce in some cases new invasive species; and

(c) *Destruction by pests and pathogens* of plants, including crops and other woody species, and animals, including livestock. Invasive alien species also threaten human health.

Habitat and ecosystem-level effects

88. Repression or exclusion of native species by invasive species, either directly by out-competing them for resources or indirectly by changing the way nutrients are cycled through the system, can have cascading effects on the food web in a given habitat and affect an entire ecosystem. Criteria are yet to be

---

6/ This annex drew essentially from the following documents which contain concrete examples of invasive alien species impacts on ecosystem, habitats and species: UNEP/CBD/SBSTTA/6/INF/9 on a global strategy on invasive alien species; UNEP/CBD/SBSTTA/6/INF/8 entitled "A guide to designing legal and institutional framework on alien invasive species"; Mack, R.N., D. Simberloff, W.M. Lonsdale, H. Evans, M. Clout, and F. Bazzaz 2000 Biotic invasions: causes, epidemiology, global consequences and control. *Ecological Applications* 10(3): 689-710; Williamson M 1999 Invasions. Ecography 22, 5-12; US 2000. National Management Plan: meeting the invasive species challenge, at www.invasivespecies.gov/council/nisc; and E.E. Lyons and S. E. Miller 1999 Invasive species in Eastern Africa: Proceedings of a workshop held at ICIPE, July 5–6, 1999. ICIPE Science Press, Nairobi; Ramakrishnan, P. S. and P. M. Vitousek, 1989. Ecosystem-level Processes and the Consequences of Biological Invasions. In SCOPE Series book no. 37, Biological Invasions: A Global Perspective. J.A. Drake, H.A. Mooney, F. di Castri, R.H. Groves, F.J. Kruger, M. Rejmanek & M. Williamson eds., 528 pp.

identified for the minimum size of population and spread needed for an alien species to impact adversely a given habitat/ecosystem.

89. In many cases, alien animals can alter a native habitat/ecosystem, e.g., through the damage caused to plants and soil. With regard to plants, replacing native species may provide poor habitat for many native animals; use huge amounts of water and decrease water supply for nearby communities; increase soil erodibility; and alter hydrological balance, nutrient availability, decomposition processes; disturb pollination of crops and seed dispersal; and intensify fire regimes. These changes will in turn alter the conditions of life for all of the organisms in the ecosystem. In particular, transformation of forests through the burning and replacement of woody species with grasses as it occurs in the Amazon basin, for example, can reduce the global capacity to sequester atmospheric carbon and exacerbate the build-up of carbon dioxide in the atmosphere, and contribute to global warming.

90. A scientific issue to be addressed in relation to the changes in ecosystems following the impact of invasive alien species is that of recombinant ecology or ecosystems emerging from new combinations of species – partly from global change, partly from the ecological impact of invasive alien species. For these emerging ecosystems there is an urgent need to examine the theory involved in ecosystem transition and evolution, through examination of case studies. In such emerging ecosystems the effects of some alien species may be less dramatic in the short term than other more invasive species. Some systems may or may not be inherently unstable with new species additions, and a research priority must be to achieve better understanding and management of the system, rather than attempt total obliteration of all introduced species. Following the ecosystem approach, adaptive management techniques are best used to contain the problem of invasive alien species in emerging ecosystems, and to derive some general principles for establishing future management paradigms.

91. Habitat disturbance and disturbance frequency, changes in climate, in particular changes in the frequency and intensity of extreme climatic events that disturb ecosystems, land clearance, intensive exploitation and pollution are some of the factors that facilitate the establishment and spread of invasive species. It can, however, be difficult to separate the ecosystem-level effects of biological invasions from those of the disturbance that created the invaded habitats.

Environmental costs and socio-economic consequences

92. Alien species have invaded and affected native biota in all the thematic areas addressed by the Convention. The scope of biological invasions is global and the cost is enormous, in both environmental and economic terms. The environmental cost is the irretrievable loss of native species and ecosystems and their non-market services.

93. Threats posed by invasive alien species to ecosystems, habitats and species translate directly into two main categories of economic consequences:

(a) Loss in potential economic output, e.g., blockage of waterways for navigation, and losses in crop and livestock production, fisheries survival, water supply and forest production; and

(b) Direct cost of combating invasive species that are threats to plant, animal and human health, either as direct agents of damage and disease or as vectors and carriers of disease-causing parasites. A recent estimate indicates an annual loss of $336 billion due to invasive alien species in the United States ($137 billion), India ($117 billion), Brazil ($50 billion), the United Kingdom ($12 billion) and South Africa ($7 billion). Scientists point out that the costs of invasions may be self-perpetuating, once they are set in motion and that damage from the invasive species already established may even increase.
