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THE MOSTINVASIVEFIVE WOODY PLANTS CONTROL RISKS ASSASMENT – STRATEGIC PRECONDITION FOR SUSTAINABLE GOVERNANCE OF NATURAL RESOURCES IN SERBIA

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Abstract: *Risks assessmentand management can play a key role in the reduction of damage caused by different types of forest pests, diseases and weeds in sustainable forestry practice development. Significant diversity of serious threats to forest ecosystems condition demands special governance instruments in a goal of increasing productivity while an environmental contamination and health hazard needs to be reduced to a minimum. Sustainable forest management can be better achieved through the preferment of appropriate assessment tools (with proper risk evaluation model developing and adapting it). During testing the increasing desire to apply the "precautionary principle" in the face of scientific uncertainty had been recognized. There's luck of scientific knowledge; studies are ongoing intensive but with decade or less delay of our country/ forest practice/ introduced plant influence research object existing results or their control usage background. Potentially serious consequences prejudgment leads to the driving force of a multidisciplinary approach in research process, with objective and invaluable field experience at the first place and guidance of it.*

Key words: Nature protection, governance, Biotechnologies, invasive species control, Serbia

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ПРОЦЕНА РИЗИКА ПРИ КОНТРОЛИ ПЕТ НАЈИВАЗИВНИЈИХ ДРВЕНАСТИХ БИЉАКАУСРБИЈИ – СТРАТЕШКИ ПРЕДУСЛОВ УСПЕХА ЗА ОДРЖИВО УПРАВЉАЊЕ ПРИРОДНИМ РЕСУРСИМА

Извод: *Процена ризика и риск- менаџмент могу имати кључну улогу у смањењу штете изазване различитим врстама шумских штеточина, болести и корова у пракси развојаодрживог шумарства. Значајна разноликост озбиљних претњи по шумске екосистеме захтева примену посебних управљачких инструмената у циљу повећања продуктивности, док би контаминација животне средине и опасност по људско здравље требало да буду сведене на минимум. Одрживо газдовање шумама лакше је остварити кроз фаворизовање одговарајућих механизама (прилагођавањемоделаза процену ризика је један од њих). Током истраживања тежило се примени "принципа предострожности" у смислу тестирања чињеница које су још увек предмет научних исртраживања, у европским земљама а и код нас. На теми истраживања генерално мало је рађено до сада у Србији ; интензивне студије или су у току, или барем деценију каснимо за земљама у региону. Пракса процене утицаја инвазивних биљака и примене корисних организама за стављање истих под контролу или у циљу њиховог сузбијања, још увек не постоји у Србији. Потенцијално озбиљно опасне последице примене мера биоконтроле упућују на мултидисциплинарни приступ у процесу истраживања. Полазне хипотезе које су стављене на проверу управо су оне добијене из шумарске праксе и теренског искуства. Валидно управљање ризиком диктира опрези неопходност при примени управљачких механизама у ситуацијама где постоји недостатак проверено доказаних научних чињеница.*

Кључне речи: Заштита природе, управљање, биотехнологије, контрола инвазивних врста, Србија

1. INTRODUCTION

Regarding the use of new biotechnologies in forestry the most common innovative procedures in silviculture and raising healthy forests in protected areas are substitution of inorganic pesticides with biopesticides and direct “tool use” of scientifically approved useful plants and animals through biological control measures in detrimental biotic agent’s suppressing. Success stories presented both with performed case studies and forest biotic agent’s research results are showed in this paper. Studies conclusions are not limited or approximated to all protected areas (PA) where plant material had been collected and members of various interest groups had been interviewed, either they are directly or indirectly involved in the decisions making as management authorities. In this regard, the investment and use of any biotechnology needs to be risk assessed on a case-by-case basis, considering the specific technology in the specific ecological, political and economic environment. Research had been performed in forest ecosystems which are managed by state PE, NP, NR… All five the most harmful IP populations occur where their existence is: barely noticed, not recognized as threats, neither need for risk assessment of their further influence... Field real problems are conflicts caused by social opposing views on the primary purpose of forest land and protection of

natural resources as units covered with forest vegetation, inappropriate agricultural and forest policies, and poor rural infrastructures. Until now Serbia has not adopted IPM (integral pest management) neither as the scientifically synchronized project studies results trial testing. This article present some proposals of proven joint activities resulted with risk assessment of five common test subjects based on facts obtained from the collected data analysis.

The aim of the present guidelines is to provide guidance to forest economy to help make monitoring a practical tool for environmental policy, especially in the development of plans and strategies on biodiversity conservation and sustainable use, the mainstreaming of biodiversity conservation objectives across policy sectors and in assessing progress in achieving policy targets and the effectiveness of conservation measures. Minimization of health, environmental and socioeconomic risks resulting from biodiversity loss and ecosystem degradation, as well as the maximization of benefits from biodiversity and ecosystems, are the main objectives.

1.1. Evolution of invasiveness

Some seemingly benign species increase invasive potential after arrival on a recipient site. Genetic drift, high genetic diversity in the founder population, or a change in selection pressures can interact to produce invader populations that have greater invasive potential than populations in the home range (Blossey and Notzold 1995, Lambrinos 2004; Bossdorf et al. 2005; Schierenbeck and Ellstrand 2009). An introduced species also has the capability to increase its invasive potential through hybridization with native species (Bossdorf et al. 2005). This evolution of invasiveness is occasionally linked to the concept of "enemy release": when introduced into a new site, a species experiences little pressure from enemies (i.e., herbivores or pathogens), and thus less energy needs to be allocated to defense, that in turn gives an evolutionary advantage to individual plants that invest more energy in growth and reproduction (Blossey and Notzold 1995). Like many other hypotheses, support for evolution of invasiveness is contradictory, with this process occurring in some invasions but not others, possibly due to the many factors interacting in invasion.

1.2. The Characteristics of Invasive Species Critical for Ecological Risk Assessment

There are four features of invasive species ecological risk assessment that are in contrast to risk assessment for chemicals and other abiotic stressors (Landis, 2004).

First, the exposure to the stressor becomes the probability of a biological invasion event even if a permanent introduction throughout the landscape does not occur.

Second, the population size of the invasive species can increase, fluctuate, or even become extinct. Third, there is a broad range of mechanisms by which invasive species can directly and indirectly impact the valued characteristics of the receiving environment. Landscape-level impacts may also occur by a change in the

ecological matrix through which migration occurs, altering the spatial relationships of important habitat patches (Shea and Chesson 2002).

Fourth, the processes that govern impacts are fundamentally ecological and evolutionary. Five invasive woody plants recognized as all criteria covered were described in paper results.

2. THE RISK MODEL

This Risk Model relies heavily on reasonable judgement by the SDM (Designated Environment Officials or Statutory Decision-Makers. SDM, could use available information from staff and others (experts for plant and forest protection- employed of Next relevant Ministries : Ministry of Agriculture, Forestry and Water Management: Ministry of Natural Resources, Mining and Spatial Planning, Institute for Nature Protection, Plant Protection Society of Serbia. The Risk Model uses numbers to represent the relative magnitudes of frequency, probability, and consequences, but the model cannot be considered "quantitative" in the sense of scientific accuracy. Using numbers simply allows various risk factors to be weighed systematically during the risk evaluation process.

Description- the following description highlights the model for evaluating the risks associated with approving an operational plan for suppressing IS in sustainable and biodiversity preserving precondition. When an SDM receives an operational plan for approval the acceptability of the controlling- suppressing plan, must considered, all things reviewed, including following:

The risks to a wide range of environmental, social and economic values of ISHE; The proposed mitigation of identified risks; The potential benefits of the proposed control or plan component; The Risk Model that follows offers guidance on the key steps in assessing risk. The approach leads decision-makers to draw risk conclusions by considering:

Values of Concern; *Potential Detrimental Invasive species hindering effect (Invasive species adverse effect; Frequency of Loss Event*; *Probability of Consequences Given a Invasive species adverse effect*; *Consequences of Loss Invasive species hindering effect*.

Instructions -to ensure consistent application of this model, users should not assign numerical values other than those suggested in any of the categories. When in doubt choose the higher risk value.

The initial entry in the Risk Assessment Matrix identifies the project or component under consideration.

Frequency of Invasive species occurrence at randomly fields – PA terrains

An important factor to consider in a risk assessment deals with the frequency of invasive species presence that could cause adverse consequences. Frequency is often expressed as the number of incidents in a given time frame, also called a "return period" for some types of invasive species which was suppressed someway. Consider the frequency of invasive species occurrence if the proposed project were approved, Select from the following four categories:
Frequent 10 points; Occasional 7 points; Seldom 4 points; Rare 1 point.

Probability of Consequences -in this step, contemplate the likelihood of consequences given a loss event. For example, what is the chance of water quality degradation if a landslide occurs as a result of the proposed plan? In the study of probability, invasive species hindering effect that will definitely happen are assigned a probability of 100 percent. Incidents that are impossible are given a 0 percent chance of occurrence, and everything else lies somewhere between these two extremes.

Consider the following three levels of probability:

Probable (*7 points)*. The likelihood or probability of the consequence occurring is greater than 50 percent. *Possible* (*4 points*) The probability of the consequence falls between 20 and 50 percent. *Unlikely* (*1 point*) .There is less than 20 percent chance that the consequences will occur. The probability factors considered in selecting among the three broad categories of probability should be recorded in the comment space.

Most Likely Consequences - The next set of factors deal with the potential consequences of the plan or component, given a loss event, such as a landslide. In large part, this step requires decision-makers to consider the resources and other values that may be affected by the plan or component.

Four categories of potential consequence are available: *Catastrophic 10 points*; *Major 7 points*; *Serious 4 points*; *Minor 1 point*. Briefly record the factors and features considered in making a determination of potential consequences.

Total Risk Level- In the evaluation of risk, consider all three factors: Frequency of invasive species hindering effect presence, probability that consequences will occur, and the extent of consequences to things of value. Combining these related risk elements is a mental process that defies a strictly scientific or structured approach. However, the model suggests a simple method that has been adopted in other types of risk decision-making: Add the values for frequency and probability, then multiply the sum by the consequence value to determine a total risk score.

If users apply this model consistently for two or more components of a plan, the scores will provide a rough indication of the relative risks of the components.

Risk Assessment Results- the foregoing analysis may be enough for some SDMs to make a determination on the operational plan under consideration. Plans that present either very high or very low risk often become quickly evident. However, recall that the assessment of risks associated with the plan is only one element to the overall decision on the plan.

If the plan promotes risks that are higher than acceptable to you, and the plan lacks reasonable means to manage these risks, you should avoid considering additional mitigation possibilities in your assessment. In doing so, you are drawing a conclusion on what is, rather than what could be in the plan and may then conclude that you should not approve the plan.

Decisions on plans or specific components may be clear where the model indicates risk levels of “very high” or conversely, “low” or “very low.” Decisions that fall into the “high’ or “moderate” risk levels may cause additional review depending on the situation.

In all respects, decision-makers should record their reasoning for approving or not approving an operational plan. SDMs should refer to the frequency, probability, and consequence elements addressed in this Risk Model, with specific comments on the factors that contribute to the greatest risks.

3. RESULTS

Results suggest that a species that is very competitive, resistant to contaminants or new control procedures, and one that can delay its dispersal until it has established a "beachhead" in the PA landscape. The beachhead patch ensures that there is a source for further migration into the landscape. The implication is that a fragmented or patchy environment will be more likely to contain an invasive because of the increasing number of areas that can be colonized and used as beachheads for further colonization. If the invasive can remain cryptic so that eradication efforts are limited until established in several refugee patches (PA habitats), the probability of a successful invasion should increase.

The models confirm work by many other researchers (see Anderson *et al*., 2004; Marvier *et al*., 2004) that there is a clear interaction between the landscape, competing species, and the invasive species. Spatial structure must be incorporated if an understanding of the possible outcomes is to be factored into the risk analysis. The interaction between control measures and the native species demonstrated that only in extreme – high risk events influence had badly the outcome of the invasion (Watrud *et al.* 2004; Landis *et al.*2000).

Five alien plant species were identified through this process/ risk model as having positive responses to the posed questions. These are listed in Table 1.

Table 1. *Exotic invasive plants in prioritized as potential biocontrol targets arranged by lines into groups of decreasing priority, but of similar priority within each group*

Species Life form* Area of origin EU climate distribution Genus native to Europe

Species	Life form*	Area of origin	EU climate distribution	Genus native to Europe	Conflict of interest†	Past or current biological control programs/ publications
Fallopia japonica	Ge	Japan	Temperate	Yes	No	Yes
Fallopiabohemica	Ge	Hybrid	Temp/Med	No‡	No	Yes
Amorpha fruticosa	Ph	N. America	Mediterranean	No‡	No	Yes
Ailanthus altissima	Ph	China	Temp/Med	No‡	No	Yes
Robinia pseudoacacia	Ph	N. America	Temperate	No	F	No

*Ph = Phanerophyte, Ge = geophyte, Hy = hydrophyte, He = hemicryptophyte, Th = therophyte, Ch = chamaephyte.

Conflict of interest: †Past or current biological control programs/ publications
†O = current ornamental interest, F = value as forestry tree – simple aesthetic value of certain aliens weeds is not considered a conflict of interest as biocontrol will only reduce their density not eradicate them.
‡Family or subfamily also not native to Europe. 1. ***Fallopia japonica*** **(Houtt.). 2. *F.* × *bohemica* Chrtek & Chrtkova**

Fallopia (Polygonaceae) contains 24 species worldwide of which seven are considered weeds. *Fallopia japonica* var. *japonica* (Houtt.) Ronse Decr., the most invasive clone (Bailey, 1994), is referred to as *Reynoutria japonica* (Houtt.) in some parts of Europe and *Polygonum cuspidatum* Sieb.& Zucc. are also invasive, although their relative importance in Europe and Serbia is still being studied *Fallopia japonica and fact that mantioned*hybrid appears to spread faster than either parent (Mandák et al., 2004), makes these two species among top five Serbia's aggressive aliens.

3. Amorpha fruticosa L.

Origin, life history and ecology - According to some sources it was introduced in the Balkan Peninsula at the beginning of the twentieth century, precisely in 1900 (Petračić, 1938). False indigo bush *Amorfa fruticosa* L. (Fabaceae= Papilionaceae: Astragalae) reproduce generative, with pods, dispersed by water, and vegetative with a strong power of sprouting. Pods yield natural insect toxic chemical, and if demanding systematically control measures by combination of chemical and mechanical measures trailed this forest weed as woody plant are practically invincible (Gagić *et al.* 2008).

Existing and potential biological control

Without finding solution that would exclude combined application of too expensive mechanical suppressing measures and environmentally eligible suspected pesticides it is possible to predict unstoppable expansion of this plant and facing with serious major problem in the near future.

Table 2. *Natural enemies of A. fruticosa*

Insect	***Biology and host preference of A. fruticosa pod pests***
***Acanthoscelides pallidipennis*Motschulsky. Coleoptera: Bruchidae: Bruchinae**	*indigo bush weevil,bruchid beetle found feeding in pods*
***Eupelmus* and *Anastatus*(Hymenoptera: Chalcidoidea: Eupelmidae)**	ectoparasitoids of weevil larvae
***Syntomaspis* sp. and *Torymus* sp. (Hymenoptera: Chalcidoidea: Torymidae)**	possibility of seed predation and hyperparasitism, both need to be proven
***Tetrastichus* sp. (Hymenoptera: Chalcidoidea: Eulophidae)**	known to encompass parasitoids of the first and second order, so it is needed to proceed the research in order to determine their status -hyperparasitism phenomena demands experimental "tricks"
(Hymenoptera: Proctotrupoidea: Scelionidae),	Reared one specimen as fresh bruchid beetle egg parasite. Investigation needs to be continue in a goal of getting more specimens, data, status confirmation and species determination
(Hymenoptera: Proctotrupoidea: Diapriidae),	Hyperparasitoid of *Eupelmus* and *Torymus* genera, until now one specimen had been reared and prepared
Acari, Pyemotidae	Predators of weevil larvae and pupa
***Pyemotes* spp. (=*Pediculoides*) verticosus, National Academy of Sciences 1978**	

4. Ailanthus altissima (Miller) Swingle

Ailanthus (Simaroubaceae) contains 10 species confined to Asia and Australia of which *A. altissima* (from temperate and subtropical China), the only member of the

family in Europe, is considered an invasive species in most temperate regions of the world.

5. Robinia pseudoacacia L.

Robinia(Fabaceae) contains four species from North and Central America, all of which are considered as weeds worldwide. Now is extremely widespread in many habitats in Serbia.

Existing and potential biological control- more recently, classical biological control of weeds has also undergone significant criticism from within the ecological and evolutionary scientific community (Louda *et al*., 1997), despite there being only a few predictable non-target impacts and the release decisions for the causal agents being made at a time when society was more risk accepting.

4. CONCLUSIONS

Classical biological control is often unjustly perceived as costly in its initial stages, with no guarantee of success and will therefore only really be possible with direct or indirect government support. For environmental and urban weeds this is even more apparent, so funding of biological control can only proceed with sympathetic, informed and 'joined up' government. Such issues are not unique to biological control, however, as many forms of natural resource management have long-term benefit timeframes and require political incentives for their adoption.

Fortunately, there is also now a groundswell of interest in European Governments over the invasive species issue, partly due to their CBD commitments and a growing recognition that many species and their associated costs are getting out of control. In order to secure funding, the responsible government department(s) [often both the agricultural and environmental ministries], need to be convinced of the high benefit–cost ratios of biocontrol, and it is here where stakeholders need to work with economists, as the analyses usually fall out heavily in favor of undertaking a biological control programme.(Sheppard et al., 2005).

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ACRONYMS

PA- Protected area
PE- Public Enterprise
NP- National park
NR-Nature Reserve
ESIAS - Environment and Social Impact Assessment Study
CBD- Biodiversity Convention
ISPM No. 3 -Guidelines for the export, shipment, import and release of biological control agents and other beneficial organisms

EPPO–European (Regional) Plant Protection Organization
IPREM - Invasive Plant Risk Evaluation Management
SDM - Designated Environment Officials or Statutory Decision-Makers
ISHE-Invasive Species Hindering Effect

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THE MOSTINVASIVE FIVE WOODY INVASIVE PLANTS CONTROL RISKS ASSASMENT - STRATEGIC PRECONDITION FOR SUSTAINABLE GOVERNANCE OF NATURAL RESOURCES IN SERBIA

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Summary

Many European countries are waking up to the scale and impact of invasive alien species, as highlighted by the recent publication of the ESIAS which aims to stem the flow. This document was developed under the Bern Convention and recommends the requirement of a 'grey list' of species posing unknown threats that need to be screened for risks before introduction, including classical biological control agents under ISPM 3.

Classical biological control offers environmentally sound and public good solutions to some important Serbia's worst alien invasive plants. It would assist EU commitments to reducing chemicals in the environment and controlling alien invasive species, while applying the precautionary approach to intentional introductions of such beneficial exotic organisms. This review highlights 5 of these and suggests, with the full support and in the context of the CBD and the ESIAS (Environment and Social Impact Assessment Study), that the time is ripe for classical biological control of weeds to break into the mainstream, alongside public demand for action and national commitments to reduce chemical use and protect biodiversity. However, this will continue to be delayed if suitable government-assisted funding streams are not established alongside processes for assessing conflicts of interest and raising public awareness on the issue of the costs of invasive species and the available solutions to them.

ПРОЦЕНА РИЗИКА ПРИ КОНТРОЛИ ПЕТ НАЈИВАЗИВНИЈИХ ДРВЕНАСТИХ БИЉАКАУСРБИЈИ-СТРАТЕШКИ ПРЕДУСЛОВ УСПЕХА ЗА ОДРЖИВО УПРАВЉАЊЕ ПРИРОДНИМ РЕСУРСИМА

Рената ГАГИЋСЕРДАР,Радован НЕВЕНИЋ, Светлана БИЛИБАЈКИЋ, Томислав СТЕФАНОВИЋ, Зоран ПОДУШКА, ИлијаЂОРЂЕВИЋ, Горан ЧЕШЉАР

Сажетак

У многим европским земљама све се више буди и развија свест о обиму и стетном утицају инвазивних врста. Тема је детаљно елаборирана и најбитнији цињенице истакнуте су у познатој публикацији ЕСИАС која има за циљ да заустави даљи ток њиховог сирења као негативног тренда. Овај документ је усвојен у оквиру Бернске конвенције, практично кроз увођење "сиве листе" условно корисних организама-врста које ипак представљају непознату претњу иза које је неопходно урадити процену ризика пре њихове примене и њиховог увођења као биолошких агенаса при успотављању контроле над инвазивним коровима у природи.

Класична биолошка борба нуди еколошки прихватљива иисплатива решења за сузбијање И контролу пет најопаснијих и агресивнијих инвазивних биљака Србије, за које је у овом раду дат и модел процене ризика од употребе њихових стетоцина. Предлози су складу са постојањем Конвенције о биодиверзитету и ЕСИАС (Студија процене ризика и утицаја на животну средину). Рад указује на важност и потребне услове за примену класичне биолошке борбе против корова. Билошке мере борбе требало би да постану средство у застити шума од јавног и националног интереса, чиме би се смањила прекомерна и еколоски неоправдана употреба хемијских средстава и испостовали основни постулати заштите биолошке разноврсности. Међутим, ово неће постати уобичајена пракса док год политика ресорних министарстава и владе не развије механизме финансирања оваквих подухвата, и док у саму праксу заштите не уђе процена ризика од потенцијално корисних организама у самој примени и њиховог утицаја на околину. Подизање свести стручне и научне јавности о овом питању, као и научна потврда и докази о биолшкој борби као најрентабилније од могућих расположивих решења биће први корак у савладавању све евидентнијег негативног утицаја од ширења инвазивних врста и великих губитака по привреду али и заштиту природних добара у Србији .