

# ASSESSMENT OF PLANT INVASIONS: THEORETICAL AND PHILOSOPHICAL FUNDAMENTALS

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## **Abstract**

There is a tendency among ecologists to regard biological invasions as obviously negative. To question value-judgements based on 'ecological evidence' I present an analysis of the impact of non-scientific values and norms on the scientific writing about introduced plants. Special concern is given to the suspicion of a xenophobic bias. Scientific terms like 'alien' or 'invasion' bear negative connotations that might influence perception and evaluation. Furthermore, the terminology often reflects a conservation bias. Like the term 'weed' the terms 'invasive' or 'neophyte' denote interference with conservation or management goals. The concept of the plant community also influences assessments. In an organism-like community, intruders necessarily are seen as afflicting the health or integrity of the whole. The concept of disturbance or the hypothesis of natural stability refer to an ideal of nature as a harmonic cosmos. From this perspective, human interventions necessarily are conceived as destructive. Conservationists tend to idealize pristine nature as intrinsically good, harmonic and stable. The opposite image of a nature 'red in teeth and claws' suggests that nature must be controlled and subjected by humans. As spreading introduced plants are neither pristine nor controllable, they are conceived as negative from the perspective of conservation. I claim that the replacement of original vegetation by a new species may not *per se* be assessed negatively, but needs further reasons. The conservation of biodiversity or endangered species is a reasonable argument, the preference for natives is not.

## Introduction

Undoubtedly, the introduction of non-native plants can have significant consequences for ecosystems. Ecology can study these effects, but, as a natural science, is limited to their description and explanation. Management decisions, however, require not only mere descriptions of environmental impacts, but their assessment. Whether impacts have to be interpreted as damages depends on scientific research as well as on values and criteria that are less obvious. How to assess plant invasions and how to deal with them is, therefore, still highly controversial.

Whereas invasions of agricultural or pasture land can simply be assessed in terms of economic losses, it is much more difficult to evaluate invasions into natural habitats. Just to adduce the costs of eradication measures is unsatisfactory because they already take for granted what had to be shown: that some kind of ecological damage has happened. The criteria according to which one might determine definitively "ecological damage" are hard to define.

Nevertheless, in some publications the assessment of plant introductions seems to require no further explanation. The mere fact of reduction of species diversity, and replacement of "natives" by "non-natives", is assumed to be undesirable.

"The replacement of a native wetland plant community by a monospecific stand of an exotic weed does not need refined assessment to demonstrate that a local ecological disaster has occurred" (Thompson et al. 1987).

If this statement would be right, any further debate about the involved criteria would be unnecessary. But there are cases where even scientists do not agree whether or not certain species are damaging. In July 1997, a controversy took place in the e-mail-server list 'Aliens' about the question *"How many preliminary work must be conducted on a given plant species before it can be deemed 'threatening' and programs initiated for the control or eradication of this species?"* While some participants endorsed preventive measures for the sake of general preservation goals, others asked for more detailed empirical research and a case-by-case approach due to the uniqueness of every single event. But they all

seemed to agree that the appropriate evaluation of new species depended on good science. Against this opinion, I will argue in this paper that assessments of ecological impacts of human actions, like species introductions, can never be a matter of science solely. Empirical quantitative studies are a necessary but not a sufficient condition for assessments. These require not only scientific evaluations but also value-judgements<sup>1</sup>. Therefore, they involve criteria that cannot be found empirically. Well-founded assessments should make these criteria explicit.

Accordingly, I start with some remarks on facts and values in ecology and the concept of scientific freedom from values. Then, I explain the method of textanalysis that I used to find explicit or implicit value statements in papers about species introductions. Presenting some results, I will highlight terms and concepts that bear normative implications. These will be discussed with regard to the aims of nature conservation. Last, I consider ethical questions as the responsibility of scientists and the characteristics of human actions.

### **Facts and values in ecology**

According to the German sociologist Max Weber, science can but describe what is, not what should be or ought to be done. Value judgements, meaning "practical evaluation of facts as desirable or undesirable" are not a question of science (Weber 1917: 499). This statement is known as Weber's thesis of 'science's freedom from values' (*Wertfreiheitsthese*). This epistemological claim is the first argument against the idea that a better scientific description of their consequences would *per se* facilitate the assessment of species introductions. Certainly, better knowledge will and should influence evaluation as well as legislation. But still, the evaluation of any empirical fact depends on more or less subjective preferences and values.

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<sup>1</sup> Assessment procedures should discriminate between 'evaluation' and 'value-judgement'. Whereas *evaluation* should concern (empirical) judgements of 'factually true or false', *value-judgement* should be limited to (moral) judgements of 'right or wrong' (Eser and Potthast 1997).

Although the separation of facts and values is a reasonable norm for science it is contrary to scientific practice. Historians and philosophers of science have shown that science is deeply rooted in, and dependent on, the historical context (Fleck 1993, Kuhn 1976). As a social enterprise, science is necessarily biased. Besides its own constitutional values, it also implies decisions about contextual values and, thus, takes normative stances (Steen 1995). Taking stances is not a bad thing in itself. A conservationist bias, for example, might be all right for an ecologist. But, following Weber, such a personal conviction has to be made explicit, so that others can decide whether or not they agree with the conclusions.

The topic of non-indigenous species tends to be biased in a particular and, in my opinion, somewhat irritating way. Let me give two examples: the German popular magazine 'natur' titled in 1991:

"Green invaders. Foreigners on their way to success. Alien plants override German herbs" (Finck 1991, translation by UE).

A newsletter by the Park Service of the Grand Canyon (Arizona, USA) informs the visitor:

"Alien Invaders: The Grand Canyon is under attack from alien plants! You can help protect our native plants by joining the habitat restoration team in removing these nasty invaders" (Grand Canyon Visitor Information, April 1996).

Sure enough, these statements are not scientific, but want to raise consciousness for problems caused by introduced species or motivate people to help prevent their further spread. Nevertheless, the language that is used appeals to xenophobic, nationalist and racist feelings that have to be rejected. If scientific assessments are based on such prejudices as well, they ought to be questioned in public.

Fortunately, there is a growing awareness among scientists about this problematic tendency in talking about 'natives' and 'aliens'. For example, James Brown stated in the global volume of the SCOPE-Programme on Biological Invasions:

"There is a kind of a irrational xenophobia about invading animals and plants that resembles the inherent fear and intolerance of foreign races, cultures, and religions. [...] This xenophobia needs to be replaced by a rational, scientifically justifiable view of the ecological roles of exotic species" (Brown 1989: 105).

Other ecologists try to eliminate offensive terms from the debate (Garthwaite 1993, Binggeli 1994) and explicitly reject unreflected patriotism (Reichholf 1996). But still, many scientists do not see that scientific concepts and theories themselves reflect certain worldviews and ideas and are therefore value-laden.

### **Analyzing texts about plant invasions**

Unlike most of the papers that were given in the '4th Conference on the Ecology of Invasive Alien Plants', my paper is not directly concerned with introduced plant species. Rather, it deals with texts about these species. This is an important differentiation: I'm not writing about things "out there", in nature, but about something existing in the texts of scientists and/or environmentalists. Therefore, my method is mainly one of linguistics. I searched through scientific publications about non-native plants in order to find hints at non-scientific influences on the scientific writing. My material are specific papers about species that are considered problematic in the European context (Schwabe and Kratochwil 1991, De Waal *et al.* 1994, Hartmann *et al.* 1994, Cronk and Fuller 1995, Pysek *et al.* 1995), as well as more general and international publications, especially resulting from the SCOPE-Programme on Biological Invasions (Groves and Burdon 1986, Kornberg and Williamson 1986, MacDonald *et al.* 1986; Mooney and Drake 1986; Joenje 1987; Drake *et al.* 1989; Mooney and Drake 1989; Di Castri *et al.* 1990).

I used the following methods:

1. Characterisation of the semantic field of relevant concepts related to species introductions by using polar opposites, according to Hard (1969). I tried to figure out how different opposites, like nature vs. culture, natural vs. unnatural, alien vs. native

and wild vs. cultivated, form part of the concept of 'biological conservation' on one hand and of 'alien invasives' on the other.

2. I interpreted signs that are used in the texts as tracks, supposing that also scientific terms not only denote one precise meaning, but also bear many connotations. Using these connotations, the signs in a text can be read as tracks of a hidden notion (Eco 1977, Ginzburg 1980, Hard 1995). The method of following tracks is a kind of unconventional reading. Associating scientific terms with different contexts, I tried to find unintended messages of intentional phrases.

## **Hidden values in scientific papers and concepts**

### *Biased terminology*

Against the ideal of value-free science, the terminology concerning introduced species reflects a conservation bias. Cronk and Fuller (1995) frankly admit this bias:

"This work approaches the subject in the context of conservation and concentrates on plant invasions as a threat to wild biodiversity. The definition of invasive plants here [...] reflects this conservation bias [...] (Cronk and Fuller 1995: xiii).

Although many different definitions of the term 'invasive' are in use, most of them include a tendency for the species to expand and this expansion is seen as bearing negative consequences for the native flora and fauna (Pysek 1995). The same is true for the term '*neophyte*', which is prevalent in Central Europe. In contrast to its scientific definition, the term '*neophyte*' in its common use not only means that the introduction occurred less than 500 years ago, but also that the species tends to invade natural areas and to replace native vegetation (e.g. Strohschneider 1991). Sukopp (1995) found that 90 % of the participants of a conference on introduced plant species used the term '*neophyte*' in association to 'naturalization'. This is exactly how Thellung had defined the term at the beginning of the century (Thellung 1918/19). Thus, to call a plant species 'invasive' or '*neophyte*' already means to evaluate it as non-desirable from the perspective of nature conservation.

### *Every-day-language and scientific language*

Besides the conservation bias of the ecology of "invasives", ecological papers in general comprise lots of expressions that also have non-scientific meanings and bear many connotations. To talk about balance of nature, about circles and interconnectedness, about diversity and stability, or about disturbance and catastrophes, does not leave the scientist emotionally unaffected. Terms from different contexts are imported into science, and they still carry their original meaning as connotation. As some of these connotations also concern moral feelings and values, they can influence the assessment.

Elton's term 'invasion' has been criticized as militaristic from the very beginning of the SCOPE programme (Groves and Burdon 1986). Nevertheless, it is still the most common term in articles explicitly dealing with non-indigenous plants (PYSEK 1995). The term 'invasion' hardly can be regarded as value-free. According to Webster's New Encyclopedic Dictionary (1993), 'invasion' means:

"1. [...] entrance of an army into a country for conquest; 2. [...] the entrance or spread of some usually harmful thing".

To term a plant species 'invasive', due to this common meaning of the term, evokes the idea that its expansion has to do with aggression and destruction. The ability of an introduced plant to successfully colonize new areas, and outcompete other species, still is characterised as "aggressiveness" in many texts (e.g. Harper 1965). Schwabe and Kratochwil (1991) describe *Solidago gigantea* as growing with "intolerant" polycormones and explicitly call its tendency to expand "aggressive". These notions of aggressiveness and harm necessarily lead to the assumption that invasive species pose a threat to others.

### *Implications of the concept of community*

Not only single terms, but also whole scientific concepts have normative consequences. For example, the concept of the plant community has impacts on the assessment of new plants. The species composition of a given plant community can either be explained by its physical environment or by the internal structure of the community. Although community

and environment influence each other, different concepts tend to lay stress on the first aspect or on the second (Treppl 1987). The so-called individualistic concept of the plant community (Gleason 1926), regards plant communities mainly as a product of chance. The availability of resources is seen as the most important factor, and competition, therefore, as the main relation between the members of the community. In an individualistic concept, any plant able to colonize a given area, and to utilize the resources, is regarded as part of the community. In the Clementsian tradition, the community is conceptualized rather holistically, as an organism (Clements 1916). In this concept, all species form part of the community as a whole, and this whole is more than the mere sum of its parts. Hence, the removal or addition of one part necessarily seems to afflict the whole, the community. Bearing an organismic concept in mind, a new species can only be perceived as damaging.

Such an organismic concept of the community is hidden in the concept of 'resistance'. Only an organism has mechanisms to repulse intruders that don't belong to it. Originally belonging to a medical context, the concept of immunity is related to the concept of disease. It is not only descriptive, but normative. Immunity is understood as an active process of an organism and requires discrimination between 'own' and 'alien', between friend and enemy (Zimmermann 1996). Its weakness or breakdown renders possible the entrance of germs. In the (normative) context of health and disease, the successful intrusion of aliens into an organism means damage. The term "ecosystem-health" (Rapport 1989, Kolasa and Pickett 1992) clearly refers to this medical context, too.

### *Traditional images of nature*

Assessments of species introductions not only depend on the concept of the community, but also on certain images of nature. Elton (1958) regarded natural communities as adapted to the potential of their habitat. This means, after a sufficient time of evolution, every possible niche is occupied. In such a saturated community, there is no room for newcomers. It is, therefore, resistant to invasions. The stability of a natural community is interpreted as a result of species diversity. This concept is clearly related to the idea of a



balance of nature. This idea is quite often reflected in ecological theories and even more often in their popular receptions (Jansen 1972, Egerton 1973, Pimm 1993). It resembles the premodern idea of a harmonic order of nature. This kind of Nature has a *telos* and, therefore, is a normative concept (Heiland 1992). According to this concept, human behaviour has to be oriented following the order of the cosmos. The supposition of a natural order necessarily leads to the evaluation of human-made changes, like the introduction of new species, as causing disorder, as destructive.

The notion of an intrinsically good 'natural' state can also be found in the concept of disturbance. Disturbances are seen as the most important means to overcome the resistance of a natural community.

"There is no invasion of natural communities without disturbance" (Fox and Fox 1986: 65).

Although there is evidence today that natural habitats are open to invasions, disturbance is still considered one of the most important factors for the success of introduced species:

"There is abundant (although largely anecdotal) evidence supporting the assertion that plant communities are generally more invisable when they are subject to some form of disturbance" (Burke and Grime 1996).

The concept of disturbance is value-laden, too. The term itself is easy to associate with disruption, destruction, intervention, and the like. Also the common scientific definition of 'disturbance' comprises the term 'disruption':

"A disturbance is any relatively discrete event in time that *disrupts* ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment" (Pickett and White 1985: 7; italics by UE).

One of the meanings of the term 'disrupt' is "to throw into disorder" (Webster's 1993). This means, the term 'disruption' is related to some kind of order. Explaining successful invasions by disturbance, theories on biological invasions tend to refer to a natural order

that is thought to prevent invasions. Fox and Fox (1986) explain the effect of disturbance with the creation of spare resources. These render possible the establishment of new species:

"New resources may be *utilised* by native species in the community or may be *exploited* by new species, either native or introduced" (Fox & Fox 1986: 57; italics by UE).

In contrasting "utilisation" and "exploitation" native species are conceived as part of the natural balance, whereas new species are regarded as disrupting this order. This theory obviously refers to Elton's concept of saturated natural communities. It can, therefore, be interpreted as a hint at the underlying image of a harmonically ordered nature that humans can only destroy.

### **Introduced species, nature conservation and ethics**

The presented textanalysis revealed some assumptions in the literature on invasions that cannot withstand a critical discussion. Nevertheless, the spread of invasive species might threaten objectives of nature conservation. These aims will be discussed in the following section.

#### *What does nature conservation mean?*

The above cited statement by Fox and Fox (1986) suggested that natural communities are free from disturbances. Contrary to this opinion, there seems to be evidence today that natural systems are in permanent change (Pickett and White 1985). Landscapes are heterogeneous both in space and time. What, then, can the idea of the conservation of nature mean (Sprugel 1991)? Especially, what can it mean in the context of species introductions? If a new species invades an area where it hasn't grown before and, due to its competitive ability, replaces the former vegetation this can be seen as a natural process. However, it is a process that is regarded as undesirable in terms of nature conservation. So what are the foundations of this value-judgement?

Most of the arguments against the introduction of new species come down to this one: that introduced species are a threat to global and local species diversity and to endangered species (Elton 1958, Jäger 1977, MacDonald et al. 1989, Starfinger 1992, Trepl and Sukopp 1993, Cronk and Fuller 1995, McNeely et al. 1995, Kowarik 1996). To regard the replacement of native plants or plant communities by an introduced one as negative, one must consent to the claim that we should preserve as many species as possible. Preservation of species diversity is a reasonable aim for conservationists, if reasoned from a utilitarian or aesthetic or moral basis. If this aim is accepted and if it is afflicted by a certain introduced plant, this can provide a strong argument for the control of the plant's further spread. However, this assessment is only valid for one particular species in one particular region. Every new case requires a new evaluation.

In Central Europe, the extinction of native species by introduced plant species is not the main problem of nature conservation. Some of the most endangered species themselves are not native but owe their existence in the area to human activities. In the European context, the appropriate argument, therefore, is not the preservation of some 'natural' state or of species diversity in general, but of the traditional cultural landscape and of endangered species. The preservation of such a particular state of nature requires arguments that involve human interests and needs.

The idea of preservation of nature is based on two contradictory images of nature. The first is the ideal of a pristine nature that is regarded as intrinsically good, sometimes even in a moral sense of the word. Human activities are supposed to spoil this natural integrity. I've shown above that one can find this image in some ecological concepts, too. Valuable nature, in this sense, is nature that doesn't show human marks. If natural areas are invaded by non-indigenous species, they can no longer be perceived as pristine. Revealing the touch of humans, introduced plants spoil the illusion of natural purity and, thus, diminish the value of the place.

On the other hand, nature is regarded as wild and dangerous. To survive, it is of existential importance for humans to gain control over the forces of nature. From this perspective,

only nature under man's dominion, the cultivated landscape, can be valuable. The idea of 'Heimat' is still very helpful to understand this aspect of nature conservation. Historically, in Germany, the idea of nature conservation has been part of the broader concept of the conservation of 'Heimat'. 'Heimat' means the place, where people feel at home. It is not pure nature but a place where humans and nature live together in harmony, dependent on each other. 'Heimat' not only provides a home for her inhabitants, but also grants security and identity.

Possibly the main reason for the negative assessment of the expansion of introduced plants is that they do not fit into any of our favorite images of nature. First, they obviously are not pristine nature. If they are natural at all, they are a symbol of 'bad' nature. Thus, they spoil the idea of a natural harmony. Monospecific stands of an introduced plant do not fit into the ideal of a balanced, diverse and stable nature. In resisting control efforts, they are nature beyond human control, a threat not only to ecosystems but also to humans. In short, 'invasive' species are not too unnatural, but too natural to be an object of conservation. Second, spreading non-indigenous plants are not a part of 'Heimat' in every sense of the word. They are 'aliens', they "don't belong" (Smith 1989), they are unfamiliar to the people. They seem to change the landscape more rapidly than humans are able to adapt to. Thus, they afflict the major function of Heimat: to guarantee stability, safety and identity.

### *Ethical considerations*

The assessment of species introductions is deeply related to much broader questions, such as: What is nature, what are humans, and what kind of relationship should humans and nature have? Such questions are the objective of environmental ethics as well. Answers to these questions are part of everybody's personal belief system. In a pluralistic world, there is no reason to assume that there is one universally right answer. Therefore, questions of right and wrong in environmental ethics and policies still are, and necessarily have to be, a matter of an ongoing discourse.

Scientists play an important role in the making of public opinion. It surely is part of scientists' responsibility to raise the public awareness of risks related to human actions. By providing a better understanding of ecological consequences of species introductions, ecologists and field biologists can, and should, contribute to political decisions concerning these species. But, due to the great influence on public opinion, scientists should be aware of the historic and social context in which they speak and act. This means, they should carefully choose their language and consider the possibility of a biased perception before they draw political conclusions from their theoretical and empirical knowledge.

Some statements in discussions about control efforts or measures of prevention show an unfortunate and unnecessary undertone of 'native is best', that is inappropriate to the question at stake. It is also part of scientific responsibility to object to such statements.

Another unhelpful undertone in the debate about species introductions is the notion of antihumanism. There is a tendency in the environmentally concerned literature, by scientists as well as by philosophers, to regard humans as a pest. Charles Elton interpreted so-called human overpopulation as the real problem behind biological invasions:

"The reason behind this, the worm in the rose, is quite simply the human population problem. The human race has been increasing like voles or giant snails, and we have been introducing too many of ourselves into the wrong places" (Elton 1958: 144).

In a more recent book about 'biological pollution', Warren Wagner writes:

"The species *homo sapiens* itself is without question the super invader of all time" (Wagner 1993: 3).

As I have shown above, such a misanthropic view is the result of opposing humans to a harmonic and balanced nature. From an ethical perspective, it is not very helpful to regard humans as a species that simply has outgrown natural regulatory mechanisms. Obviously, humans are also a biological species and their behaviour might still be influenced by their

evolutionary inheritance. But the interpretation of environmental problems like air pollution, habitat degradation and species extinctions, merely in terms of biology represents an inadmissible oversimplification. Population growth, landuse-systems, industrial production and species introductions depend much more on economy and politics than on population biology. If we want to solve these problems, we have to presuppose that humans are more than a peculiar animal species. Responsibility is exclusively human and not natural. To have an addressee for our moral and political demands, we have to accept this.

## Conclusions

### *Which nature do we want?*

Assessments are a matter of judgement and not a matter of fact. Therefore, the ecological description of a phenomenon, and its evaluation as desirable or undesirable from a practical perspective, should be kept apart. The evaluation of the expansion of a given species as damaging has to be based on certain values or criteria. To assess a plant as a weed requires a clear articulation of management goals. Managers of parks, preserves etc. should clearly articulate what they are managing for and only then determine which species interfere with management goals (Randall 1997). Instead of generalized condemnations of non-indigenous species, a case-by-case-approach should be taken, that should mainly consider the actual situation:

"The most important question is the impact of the species on the site in question rather than whether it is unwanted elsewhere or indigenous to the site" (Randall 1997).

The claim for a clear articulation of management goals implies the approval of their arbitrariness. There is not only one nature but many and we have to decide which one we want. In this decision, we tend to rely on traditional images of nature. I have presumed that one reason for the negative assessment of invasive alien plants is that they do not fit into our favourite images of nature. Expanding non-indigenous plants neither fulfil the ideal of unspoiled pristine nature nor that of a harmony within nature or between humans and

nature. Introduced plants are not harmful to nature as such, but to the nature we want to preserve.

### *Values related to the assessment of plant introductions*

The ethically required separation of facts and values is hard to accomplish. Science borrows its concepts and terms from everyday language. Thereby, it also imports the related values as connotations. These implicit values can influence value judgements without being noticed. The terminology, as well as some basic concepts, used to describe and explain plant introductions and their consequences are heavily value-laden. Terms like 'alien', 'invasion', 'resistance' or 'immunity' are associated with the idea that the entrance of something extraneous means harm to a community. If borders are supposed to be part of a natural order, their overcoming seems to be undesirable. Both, the non-acceptance of the naturalization of foreigners and the clinging to a rigid order, have parallels in social life that should be critically borne in mind.

Realizing that some of the involved criteria are problematic, because they reflect a xenophobic bias, does not mean to deny that introduced species can threaten objectives of nature conservation. However, to be aware of the political and social context in which this discussion takes place should result in a more precise denomination of the problems at stake. If ecologists do not want to feed common prejudices against foreigners, they should refrain as far as possible from biased terminology and from highly emotionalised presentations of the consequences of species introductions. Whereas local or global species diversity, as well as the uniqueness of a particular ecosystem or landscape, are legitimate arguments, the nativity of a species should play a minor role in the discussion.

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