Buffer Zones Around Protected Areas: A Brief Literature Review

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This literature review is based on 53 articles (26 from peer-reviewed journals). Forty-two of these articles specifically refer to the type of buffer zones analyzed here. The main goals set for this review are to identify the principal issues around the buffer zone concept at the present date and to determine the main problems and advantages of the concept. It is clear from the review that there is no agreement among conservationists regarding what is, or should be, the role of buffer zones. Due to this, confusion arises on what the objectives of buffer zones are. Two antagonist positions are identified. One proposes buffer zones as an extension of national parks and the other argues for buffer zones whose major role is to integrate parks and people. I conclude that regardless of the position taken there is an urgent need for a clear definition on the objective of buffer zones.

The importance of a literature review on buffer zones is highlighted in a recent article by Prins and Wind (1993) which indicates that buffer zones, and the effective use of them, is one of the major priorities in the conservationists' and wildlife managers' agenda (p. 44). This literature review is based on 53 articles of which 26 come from peer-reviewed journals. Of these 53 articles, 42 specifically refer to the type of buffer zones I focus on here. That is, buffer zones located around protected areas or similar conservation approaches. Buffer zones around agricultural sites, fumigated areas[1], garbage dumps[2] and other kinds of buffer zones designated to protect the 'outside' from the 'inside' content are not part of this review. In addition, riparian buffer zones[3] and marine buffer zones are not part of this study either.

The main goals set for this review are to identify the principal issues around the buffer zone concept at the present date and to determine the main problems and advantages of the concept. I begin with a presentation of Figures 1 and 2. The objective of Figure 1 is to show what the main topics of the articles are. If an article focuses on more than one aspect of buffer zones, both aspects were entered into the graph. Not all the articles focus entirely on buffer zones, but the ones that do generally focus on one or more of the issues represented in the graph. Figure 1 shows that Integrated Conservation and Development Projects (ICDPs) are the main concern, even in the articles that also raise biological concerns. Unexpectedly, only one article focuses on edge effects. This is quite surprising considering that edge effects are an important biological factor for considering the establishment of

buffer zones.

Figure 1. Main focus or foci of buffer zone analysis in the articles.

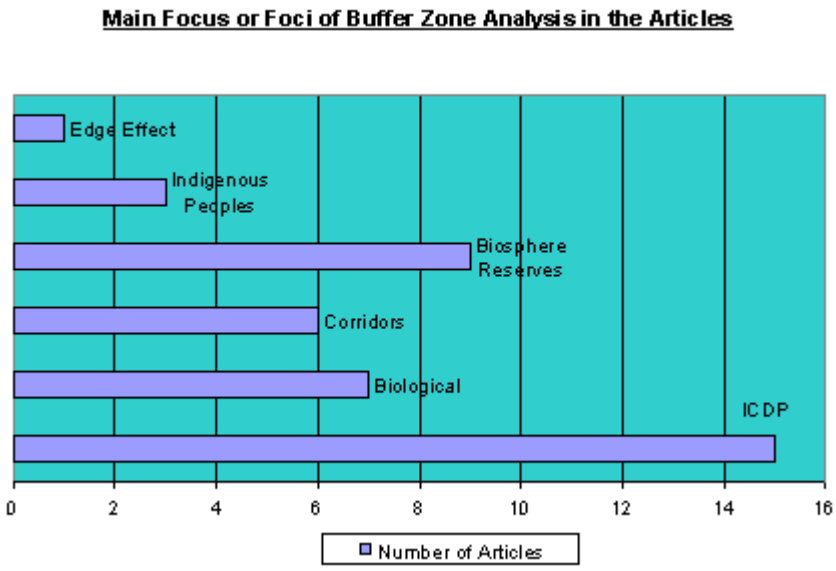
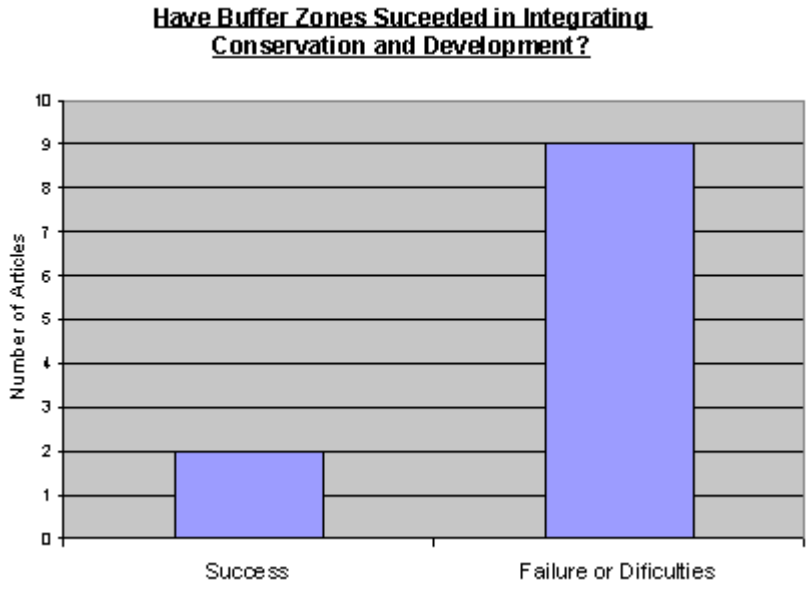


Figure 2 shows the number of articles that conclude that buffer zones in general or in a particular case had failed or succeeded. The reason for the low number of articles is that not every article is based on a case study and not every author had a conclusive opinion on whether buffer zones had succeeded or were having problems. However, it is very clear from the results that the concept is having problems in its implementation.

Figure 2. Buffer zone success.



The following statement from Heinen and Mehta (2000) summarizes the results of both graphs: "There are few studies that test the effectiveness of buffer zones, and most of those have focused on the socioeconomic as opposed to the ecological buffering functions" (p.48).

Origins

Many authors agree that the term *buffer zone* became widely used with the Man and the Biosphere (MAB) program and the Biosphere Reserves (BRs) in the 1970s. UNESCO's Man and the Biosphere programme launched the concept of BRs in 1976 and by mid 2000 it included 368 reserves in 91 countries (UNESCO 2000). The first 57 BRs designated in 1976 were selected mainly for their role in conservation. Through the years the criteria for selection has been shifting. During the first years BRs had similar objectives to those of national parks and other protected areas designed with the main purpose of preserving biodiversity. Many of these BRs were, in fact, created in areas where national parks already existed (Daniele, Acerbi, & Carenzo, 1998) or the national park was used as the core area of the BR, which consisted generally of three concentric rings. The inner ring was the core area, the second ring a buffer zone, and the third ring a transition zone. Shafer (1999) found that the need for buffer zones was being discussed in 1933 in the United States under the term 'buffer area,' which by 1941 had became 'buffer zone' (p. 51). Moreover, in 1963 the Leopold Report stated that in places where hunting grounds were firmly established there should be a core area, and buffer zones should be established "in the form of national recreation areas where hunting is permitted. Perhaps only through compromises of this sort will the park system be rounded out" (Callicott &

Nelson, 1998, p. 118).

The MAB program has had a profound influence on the concept of buffer zones. However, there are some differences between the idea behind buffer zones in the MAB program and the goals that many authors want to see achieved with the establishment of buffer zones. For this reason, later in this article, I will analyze these different approaches and the consequences.

The main topics for discussion in this review are:

Lack of a clear definition
Extension of protected areas' restrictions
Two-way buffer zones, or double-sided effect of buffer zones
Integration of development and conservation

I begin and end this work by reviewing and analyzing the definitions of buffer zone presented by different authors. I analyze the other three points in the same section. Although these three topics were easy to distinguish in the literature, there is a strong relationship between them.

Definitions

Wells and Brandon (1992) refer to the importance of analyzing the definitions. They state that "current buffer zone definitions are inconsistent and overlook practical problems, and this precludes their implementation in all but very limited circumstances" (p. 27). Two of the most commonly cited definitions of buffer zones are:

Areas "peripheral to a national park or equivalent reserve, *where restrictions are placed* upon resource use or special development measures are undertaken to enhance the conservation values of the area" (Sayer, 1991, p. 2).

"Areas adjacent to protected areas, on which *land use is partially restricted* to give an added layer of protection to the protected area itself while providing valued benefits to neighboring rural communities" (Mackinnon as cited in Wells & Brandon, 1993, p. 159).

Restriction in land use systems is clearly present in these definitions of buffer zones. Other definitions also emphasize this characteristic of buffer zones (Neumann, 1997; Wells & Brandon, 1993, p. 159). On the other hand, some definitions present these restrictions in a different way, perhaps in a move to avoid opposition from the people affected by them. Instead of referring to restrictions, they place the emphasis on the type of activities permitted, leaving it clear that there are other activities that should not be

allowed. Meffe and Carroll (1994), for example, define buffer zones as "an area in a reserve surrounding the central core zone, in which nondestructive human activities such as ecotourism, traditional (low-intensity) agriculture, or extraction of renewable natural products, are permitted" (p. 559). In the same vein, Brandon (1997) envisions the following activities to be permitted in buffer zones:

hunting or fishing using traditional methods, collecting fallen timber, harvesting fruit, seasonal grazing of domestic stock, and cutting bamboo, rattan, or grasses. In ecological terms, buffer zones promote land uses and practices that are compatible with contiguous parks. (p. 94)

The definitions are clearly focused on the social impacts of buffer zones and the ecological goals; reasons for establishing the buffer zones are not clearly stated. Because of the urgency to consider the needs of local people, there is, at least in the definitions, an emphasis on the social importance of buffer zones. However, some authors conclude that for buffer zones to achieve their goals (though they do not clearly state what these are) the priority should be to protect the park, and benefiting local people is a secondary function (Wells & Brandon, 1993).

It is fair to say that for these authors the 'real' objective of buffer zones is to protect the park or protected area from outside disturbance[4]. However, when it comes to determining the success or failure of the buffer zone, the analyses do not focus on monitoring changes in wildlife habitat inside the protected area, the increase or decrease in the numbers of individuals of a particular species, nor on the amount of stress on wildlife. The analyses are focused on whether or not the human population living in the buffer zone is better off than before the establishment of the park, or whether the ICDP has accomplished its goals. By saying this, I am not denying the needs of local populations. There is no doubt that resources should be available for them to use and, in fact, in some cases protected areas should provide for them (Wild & Mutebi, 1997; Martino, 2000). However, if buffer zones are designed to help achieve the conservation needs of the park, then the analyses of buffer zone results should be based on whether or not those conservation needs were accomplished.

ICDPs, extension of restriction and ghost benefits

This lack of a clear definition of the goals of buffer zones seems to be due to the double task proposed (conservation and development) for buffer zones. This double function, at least in writing, comes from the realization by conservationists that conservation cannot be imposed with guns and fences. Although the goal of buffer zones is still to protect biodiversity, this

protection has to be harmonized with the creation of benefits to local people. However, the question still remains (and it is an important question indeed) as to whether this harmonization comes from a genuine interest in local people or from the need to defuse opposition to the protected area. I have argued elsewhere (Martino, 2000) that although ICDPs show concern for local population, the main role of these projects is conservation. The inclusion of local people in development projects that take place either in the buffer zones or near the protected areas is aimed to protect those areas from local peoples' discontent rather than to integrate local peoples' need to access the protected area for resources. In Neumann's (1997) words, "we need to understand how the development interventions in buffer zones relate to conservation. Many of the projects reviewed are *designed not to improve livelihoods, but merely to defuse local opposition*" (p. 577). This is a crucial point that comes from the very definitions of buffer zones and that has many scientists convinced that buffer zones are failing (see Figure 2) and many others wondering what should be the role of buffer zones. But how did we reach this point?

The reasoning behind the establishment of buffer zones is generally the following: There is a need to protect the park from encroachment from local population and from the destructive activities that take place outside the park but that affect conservation inside. However, there is recognition of the legitimate needs of the local population. Many authors believe that providing benefits in the buffer zone will create an incentive for local people and provide for their needs, and the result will be that local people will not extract resources from the park anymore. This line of thinking is followed by Nepal and Weber (1994) who state, "Establishment and maintenance of buffer zones is regarded as one of the suitable strategies for resolving any existing or potential conflict" (p. 332). Other authors following this logic are Shyamsundar (1996), Vandergeest (1996), and Heinen and Mehta (2000).

However, Wells and Brandon (1992) believe that

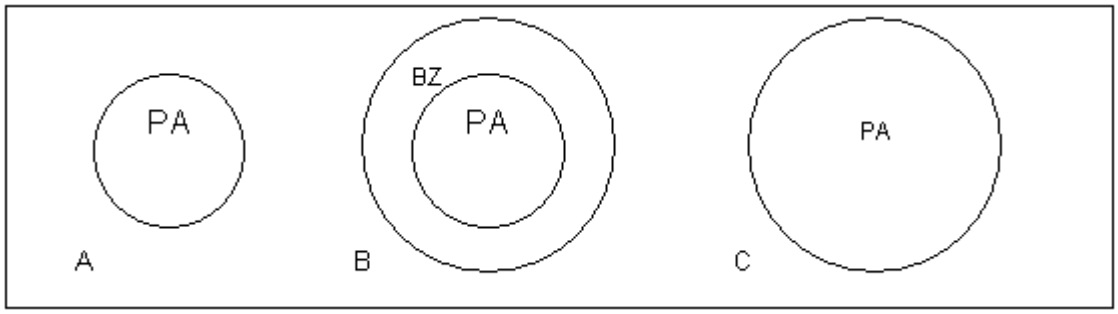
one of the most serious problems with buffer zones is the implication that the limited benefits that can flow to local people can change their behavior, reduce pressure on the plants and animals in the protected area, and thereby enhance the conservation of biological diversity. It is difficult to find logical reasons for this expectation. (p. 27)

Moreover, in a later article (1993) they point out that "the popular idea that buffer zones provide a way for local people to genuinely benefit from the existence of a protected area must be carefully qualified" (p. 159).

On the one hand, there are authors advocating the use of buffer zones to

improve the life of local population in order to stop these people from encroaching on the protected areas. On the other hand, there are authors who believe "that buffer zones should have park protection as their first priority, with benefits accruing to local people taking a secondary role" (Brandon, 1997, p. 109). However, outside the academic discussion, there seems to be no doubt that buffer zones have not been a source of life improvement for local people. This is a logical result of the buffer zone concept. To explain this point I present Figure 3, evaluate which are the 'benefits' that local populations receive from buffer zones, and then analyze the ecological benefits presented by different authors.

Figure 3. Scenarios of protected areas.



Scenario A in Figure 3 represents the original Protected Area. The situation in the area requires the establishment of a buffer zone. So the solution proposed is to establish the buffer zone as Scenario B shows. But if only the biological or ecological elements were considered, would not Scenario C be the preferable scenario? It is evident that having an extended protected area will accomplish the biological goals set for the buffer zone. So why have buffer zones at all? The conclusion is that there has to be a difference between the management and goals of the buffer zone and the management of the protected area, if not, there would be no logical reason for buffer zones to exist. However, using the term buffer zone might allow protected areas to expand with less opposition. This point will be analyzed below.

From the analysis of Figure 3 I conclude that buffer zones have to be different from protected areas. Either there are fewer restrictions than in a protected area or there are benefits for local populations from the establishment of the buffer zone. But what are those benefits? According to Mwalyosi (1991),

To minimize conflicts across boundaries between the Park [Lake Manyara NP in Tanzania] and adjacent villages, buffer zones with partially restricted land use are essential. These would give an added layer of protection to the National Park, *while providing valued benefits to neighbouring villages*. (p.

176)

However, this article does not specify what those benefits are, and it looks like the population will only receive restrictions from the buffer zone. In addition, and to support this assumption, some of the plans for the establishment of corridors involve relocation and compensations (Mwalyosi, 1991, pp. 176 & 180-181). An article by Nepal and Weber (1994) makes constant reference to the hypothetical benefits that local people would receive from the establishment of the buffer zone, but there is no mention in the article of what those benefits might be. Moreover, the majority of the people surveyed near the park preferred relocation to living in the hypothetical buffer zone. As Wells and Brandon (1993) point out, "it might be difficult to convince local people that restricted buffer zone access constitutes a valuable benefit if they had unrestricted use of the area prior to establishment of the protected area [or the buffer zone]" (p. 159). This has some authors like Neumann (1997) arguing that "many of the new projects replicate more coercive forms of conservation practice and often constitute an expansion of state authority into remote rural areas" (p. 559). He states that,

Rather than representing a new approach, many buffer zone projects and other ICDPs more closely resemble colonial conservation practices in their socio-economic and political consequences. In actuality, many buffer zones constitute a geographical expansion of state authority beyond the boundaries of protected areas and into rural communities. (p. 564)

Neumann presents examples from Madagascar, Tanzania (Selous Game Reserve) and Cameroon (Dorup National Park) in which the establishment of buffer zones resulted in "new forms of state intervention and restrictions on land use" (p. 564).

There seems to be general agreement on one of the social benefits from buffer zones. This is the buffering effect from the damage of wildlife on crops and from the dangers that wildlife or wildfires might represent for population living close to the park (Vujakovic, 1987, p. 196; Eisenberg & Harris, 1989, p. 179; Noss, 1996).

As I pointed out above, there are differences between the idea behind buffer zones in the MAB program and other approaches to them. Biosphere Reserves envision buffer zones as places in which experimentally sustainable development alternatives can take place. There is even the intention to "*ensure that all zones of biosphere reserves* contribute appropriately to conservation, sustainable development, and scientific understanding" (UNESCO, 1995, p. 4). Wild and Mutebi (1997) present a similar approach to

buffer zones but they tried to avoid the use of that term for the negative connotations it has in Uganda. They suggest that a weakness of the buffer zone concept is that "it was originally designed to buffer the conservation area from the depredations of the community, and it still carries this connotation" (p. 48). They further state,

With a greater appreciation of the reality of the local community situation, and the inequity of some conservation measures, has come the realization that the community needs buffering from conservation. Given this new appreciation we recommend that buffer zones are renamed 'support zones.' This recognizes the ideal of mutual support between local communities and the conservation area. (p. 48)

More than 'just' recognizing the 'ideal mutual support,' this kind of approach leads to a more interactive relation between the park and local population. In this particular case, harvesting of several resources is permitted inside the protected area. It is much easier, and makes more sense, to establish restrictions in the buffer zone if some benefits will be available form the protected area as well. A somewhat similar approach is presented by Shafer (1999) in the case of "Parks Canada's five-zone system [that] creates buffer zones inside the authorized park boundary instead of surrounding it" (p. 57).

Objectives

I suggested above that the reason for the debate on the benefits of buffer zones, and for the negative analyses shown in Figure 2, is the lack of a clear objective for buffer zones. I also pointed out that the reason for this blurry objective was the need to put together conservation and development projects. This point is shown clearly in Figure 1. What objectives do the authors suggest for buffer zones and what should be the objectives for buffer zones to succeed?

It is easy, when presenting the objectives, to fall on the temptation, as some authors do (Mwalyosi, 1991; Wells & Brandon, 1992, 1993; Pendelton, 1992; Nepal & Weber, 1994), of getting as close as possible to Scenario C of Figure 3. However, as I concluded, buffer zones need to have a different role in conservation for them to have a logical existence. If not, the only role would be to extend the park boundaries under a designation that raises less opposition. However local populations already view buffer zones with suspicion (Nepal & Weber, 1994; Wild & Mutebi, 1997; Götmark, Söderlundh, & Thorell, 2000).

If it is decided that the main objective of buffer zones is to protect the park from external threats, then why place ICDP projects within their boundaries.

Why place a development project in a place that will, by definition, count with less resources? Moreover, even when the project becomes successful it is considered not to be so because it is attracting people to the area and thus endangering the park (Schaik & Kramer, 1997, p. 221; Honadle, 1993). ICDPs are important outside park boundaries and outside buffer zones whose objective is to protect the park from external threats, from edge effects, from fires generated outside the park, and from other possible dangers generated outside the park's boundary.

On the other hand, if it is decided that the buffer zone is going to be an area to integrate social development projects with conservation, then a totally different set of goals and objectives are presented. In this case it makes sense to suggest scenarios like the one presented by Wild and Mutebi (1997) and by Shafer (1999) or objectives like the ones suggested by Sanderson and Bird (1998) who state, "The objectives of this zone are to achieve the sustainable use of natural resources, especially through traditional activities that benefit both the local communities and natural resources" (p. 444).

What is crucial is to reach a clear objective for the buffer zone and to analyze its accomplishments considering that objective. Wells and Brandon (1993) touch on this issue:

We argue for a considerably more restricted use and application of the term buffer zone to (a) emphasize park protection and relegate the supply of local economic benefits to a secondary role; and (b) focus on specifically designated areas of land along protected area borders. Buffer zones would then have an important role to play in ICDPs, being physically situated between protected areas and broader efforts to promote social and economic development outside park and buffer zone boundaries. (p. 160)

Ecological benefits and design of buffer zones

We saw in Figure 1 that the focus of buffer zones analyses is on the social aspect. Salafsky (1994) states that there are reports on the effects of buffer zones on local communities or on the socio-buffering side but that there are very "few studies that report testing potential land-use systems ... to examine the suitability of these buffer-zone land-use systems for extending animal habitat" (p. 457). In some cases the goal of wildlife conservation is so lost that an article proposes changing the park boundaries-as if the park had been designed without considering any ecological reasons-because antagonism is not good for "the success of socio-buffering activities or for the park protection" (Shyamsundar, 1996, p. 72).

However, several authors refer to the ecological or biological benefits of

buffer zones. In their analysis of buffer zones Wells and Brandon (1992) distinguish between biological and social benefits. The biological, or ecological, benefits are a result of the territorial expansion of the protected area that keeps human impact further away (p. 26). Some of these benefits are:

> Physical barrier from human encroachment
> Protection from storm damage
> Enlarge the natural habitat and reduce edge effects
> Enhance the environmental services provided by the reserve

Barzetti (1993) states that buffer zones are important for the conservation of species with high mobility (p. 66). In a similar case, Noss (1993) shows that buffer zones with no houses showed less abundance of songbirds due to the cat and grey squirrel population. Götmark et al. (2000) advocate the use of buffer zones to improve the function of small forest reserves in Sweden. Finally, Shafer (1999) states that buffer zones can increase the population of rare and common species by softening the edge effect (p. 54). This is, as I pointed in Figure 1, the only article that makes a direct mention of the role of buffer zones to minimize edge effects.

Regarding the design of buffer zones, Li, Wang, and Tang (1999) state that

the most unjustifiable aspect of design of the buffer zone for reserves is that its width is usually the same size all around the reserve and does not vary with the importance of the influences in the different sections around the reserve. (p. 159)

Heinen and Mehta (2000, p. 48) and Shafer (1999) also refer to this point. Shafer says that "more than one buffer zone prescription can be needed for a park" (p. 55). It is worth noting that all the articles referring to this aspect of design are very recent. On a different aspect of design, Meffe and Carroll (1994) state that,

It may seem intuitively obvious that the vegetation and other community characteristics of buffer zones should resemble those of the protected natural areas they surround. However, there are situations in which the transition from core reserve to buffer zone should be abrupt, and the buffer zone habitat very different from that of the core reserve. Whether to have an abrupt or a gradual transition in the buffer zone needs to be considered on a case-by-case basis. (p. 294)

As stated at the beginning of this review, my intention was to begin and end with an analysis of the definitions of buffer zones. After the review and the

discussion, there is one definition that I want to highlight. Wild and Mutebi define a buffer zone as

any area, often peripheral to a protected area, inside or outside, in which activities are implemented or the area managed with the aim of enhancing the positive and reducing the negative impacts of conservation on neighbouring communities and neighbouring communities on conservation. (p. 48)

This definition allows for buffer zones inside or outside the park, it shows the two tasks of buffer zones without confusing goals, and it presents in a positive way the interactions that can occur between the local population and the protected ecosystem.

Conclusion

The main goals for this review were to identify the main topics related to buffer zones and to determine the problems and advantages of the concept. It is clear from this review that there is no agreement on the role of buffer zones. It is also clear that scientists do not agree on the role of buffer zones, and for this reason confusion arises on what the objectives of buffer zones are. Two major sides can be identified among authors. On one side, many authors propose buffer zones as an extension of national parks and at the service of these areas-though they recognize, at least in paper, that the local population has to receive some benefits to avoid conflict. On the other, some authors argue for buffer zones whose major role is to integrate parks and people, even if it is necessary to use some resources from inside the park.

Whatever the role proposed, I suggest that there is a need for a clear definition on the objective of buffer zones. Moreover, without this clear definition, the success or failure of buffer zones cannot be analyzed. Because of the logical differences that have to exist between buffer zones and protected areas (Figure 3) and due to the restrictions and injustices that resulted from the establishment of protected areas during the last century, I advocate for a definition along the lines of the one presented by Wild and Mutebi (1997, p. 48). Although it is important to reach a general agreement on the objectives of buffer zones, it is crucial to consider local situations in every single case.

End Notes

[1] Marrs, Frost, Plant, and Lunnis (1992, 1993) and Blackwell, Hogan, and Maltby (1999) deal with buffer zones around fumigated areas.

[2] The School of Architecture of the University of Virginia defines these buffer

zones as "neutral area which acts as a protective barrier separating two conflicting forces. An area which acts to minimize the impact of pollutants on the environment or public welfare. For example, a buffer zone is established between a composting facility and neighboring residents to minimize odor problems. The area around a landfill which must be maintained unaltered. In Virginia, the state requires that a 100 foot buffer be left around all landfills, and a buffer must be also maintained between a landfill cell and a body of water" (University of Virginia School of Architecture, 1997). Also see Saskatchewan Waste Reduction Council (1997), and Inter-American Development Bank (1998).

[3] For information on riparian buffer zones see Correll (2001), Welsch (1991), Tjaden and Weber (1997), Vouri and Joensuu (1996), and Blackwell et al. (1999). Two literature reviews on the subject are Belt, O'Laughlin, Merril (1992) and Correll (1996).

[4] Reid and Miller (1989) take a similar stand and define them as a "collar of land managed to filter inappropriate influences from surrounding activities" (quoted in Shafer, 1999, p. 49).

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