

3,022 words [with references]

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Environmental Consequences of War

War affects nature in two ways. The direct effect works through the immediate killing of flora and fauna, say the defoliation of trees and killing of mangrove stands during the Vietnam War or the wanton killing of elephants to trade ivory for weapons in African civil wars. The indirect way affects species by depriving them of key elements or even the entirety of their habitat. For example, the oiling of Saudi Arabian beaches during the 1991 Persian Gulf War smothered food sources for migrating shorebirds, and the bombing of Pacific coral reefs during World War II destroyed whole habitats.

The examples suggest that war is unambiguously detrimental to the natural environment. The reality, however, is much more complex. The factual record of what happens to nature in war can be difficult to establish. For many war regions, pre-war baseline data are not available so that comparisons to eventual post-war data cannot be made. To assemble credible data during war is often dangerous. Field-based sampling of soil, water, and air or conducting species counts may not be possible. To construct complete arrays of physical, chemical, and biological aspects of the biotic and abiotic environment is very complex and costly. For these reasons, the scientific record of war's effects on nature is actually very thin.

Interstate wars

Only three large-scale, international wars have been intensively studied with respect to their effect on nature. Even here, the record is incomplete. The specific environmental and ecological effects of herbicide spraying on nonhuman species in Vietnam (1960s and 1970s) are disputed.

Undisputed is that spraying killed many trees, especially among mangrove stands. The opened canopy led to colonization by fast-growing bamboo grasses. To prevent eventual succession by tree species, villagers kept the spaces open by fire and by conversion to agriculture. One form of human agency (war) caused the initial destruction, another form of human agency (peace) maintained it. The density and quality of Vietnam's forests prior to the war is disputed. Moreover, the debate focused on the damage done to commercial tree stands and economic revival, rather than on environmental and ecological effects.

Relative ignorance is compounded by inattention. The largest estimate of the area sprayed, 26,313 km² (Stellman, *et al.*, 2003) is only little more than one-third of the estimate of land areas affected by bulldozing, bombing, and shrapnel (Westing, 1976). Yet these areas remain unstudied, even though it is now quite possible to return to the forests. Thus, we know virtually nothing about the long-term ecological effects the war may have had on the nonsprayed forest areas.

With two exceptions, the Persian Gulf War of 1991 resulted in small ecological effects (Green Cross International, 1998). One concerns some of the mangrove stands in the bays just west of Abu Ali Island in Saudi Arabia. Other marine and intertidal resources have recovered. The war's effects were transitory, with no lasting damage. The other exception concerns the Kuwaiti desert. Heavy soil churning during the Iraqi invasion, the subsequent counterattack, and activity related to the putting out of oil fires and reconstruction of oil facilities, presumably adversely affected desert soil, flora, and fauna. But convincing studies to demonstrate the point are sparse. Monies went to pay for the recovery of human economic activity, not for soil and desert ecology studies.

The 1999 Kosovo War also resulted in few, if any, detrimental ecological effects; at

worst, they were highly localized. Notwithstanding reports about the release of dangerous chemicals from attacked industrial sites, or the detection of depleted-uranium munitions residues, little by way of actual damage to the environment and to wider ecological processes has been demonstrated (UNEP, 2001, 2002, 2003).

Intrastate wars

Interstate wars tend to be of relatively short duration. In contrast, intrastate wars frequently last for decades, for example some fifty years in Colombia, twenty years in Sri Lanka, and forty years in Angola. They also differ in that the primary weapons used are not tanks, bomber aircraft, and cruise-missiles, but small arms, such as bladed weapons and hand-held firearms.

Modern firearms, combined with local mobility and global distribution networks, can result in heavy poaching and resource extraction. This applies especially to African cases. Poaching does not appear as a major concern in Asian and Latin American civil war cases. Several reasons may account for this difference. First, the majority of the remaining big animals – elephants, rhinoceroses, hippopotamuses, and gorillas – are found predominantly in African countries. Relatively speaking, they are (or were) present in large numbers, easy to locate, and easy to shoot. Second, conservation programs tend to focus on “charismatic megafauna” so that the outside world would be expected to receive more reports about their fate than for poaching that might affect lesser known animals such as ungulates, monkeys, or birds. Data collection is biased in favor of the better known animals.

Third, differences in the nature of the wars in Africa as opposed to those in Asia and Latin America may account for the differential amount of poaching. For example, the wars in Burma (Myanmar) and Indonesia are cases of repression and armed resistance rather than cases of outright civil war. The number of weapons available to opposing groups appears small. Their

use for poaching would be limited also. The Afghan wars were international rather than civil wars – the Soviet invasion in 1979 and the U.S. bombing in 2001 (about either of which little is known) – and its internal wars were inter-regional tribal rather than cross-regional civil wars. A tribal war is less likely to result in deliberate poaching as this would undermine a people's own lands. This may explain the Nicaraguan situation, especially for indigenous groups located on the Caribbean coast, where poaching was limited during the 1980s war.

In contrast, African civil wars tend to be wars for domination over the entire political realm of the country, even as many of them degenerate into resource extraction to finance war or greed (timber, oil, diamonds, metals). A major factor facilitating poaching is the relative ease of transport, especially on the savanna or open plains. Motorized mobility and guns are a deadly combination for wildlife (Ostrowski, Massalatchi, and Mamane, 2001).

Poaching may be inversely related to crowding. In Liberia, rebels, soldiers, and civilians sought shelter in forested areas. Shooting reveals location, and because it is more dangerous to reveal location in the forest than in the open, the level of gun-based forest poaching appeared to fall. Poaching then took the labor-intensive form of setting snares or traps which, being *in-situ*, bind the poacher to a place and deprive him of mobility. The animal has to come to the trap instead of the poacher going after the animal. A stationary, unarmed poacher will do less harm than a mobile, armed one.

Intervention can have perverse effects. In the Central African Republic, during violent conflict there in the 1990s, a program to stop poaching of forest elephants in a nominally protected nature preserve was successful but the diminished threat of encountering armed poachers led to other intrusions, such as illegal logging (Blom and Yamindou, 2001).

The length, location, and financing of conflict appear of importance. Episodic war allows

periods of recovery. The wars in Nicaragua, Rwanda, and Afghanistan did not affect the whole of these countries in equal measure at every point in time. In contrast, when wars affect large areas continuously and without any intervening let-up, as in Angola and the Sudan, deleterious environmental effects of war are more likely. When war is financed from outside, reports of natural resource extraction are muted but when war must be financed from within, it appears that it is ultimately financed via the world markets to which unsustainably harvested resources are shipped.

Refugees and returnees

The clearest evidence of environmental consequences of war, even if the magnitude is difficult to discern, comes from the impact of refugees and returnees. The cases of Rwandan refugees in eastern Congo, Afghans in Pakistan, and Kosovars in Albania are convincing, as is the lesser developed case of Colombia. Cities become more crowded than they already are, leading to environmental stresses, often mediated via inadequate water, sewage, and waste disposal facilities, and to environmental degradation in the immediate vicinity. This mostly affects humans rather than wildlife, already scarce in urban areas. In South Vietnam, people fleeing from the countryside sought shelter in Saigon whose population increased from 250,000 to 3 million (Orians and Pfeiffer, 1970). Some 500,000 Rwandas fleeing eastward in 1994 created Tanzania's second-largest urban area (Paskett, 1998). A bio-chemical assessment of damage to industrial installations in the Croatian war found uncontrolled releases of dangerous chemicals into the nearby environment (the effects of which, however, are not known) and also that much of the water, sewage, and other treatment facilities had been destroyed (Richardson, 1995). This, combined with population movements seeking refuge, can completely overwhelm cities and exposes the population and nonhuman environment to grave dangers.

When refugees flee to rural areas they often aggregate in camps from which they then set out to supplement their needs if these are not met by relief agencies. Refugees will make uncontrolled use of local natural resources, often depleting them. Long-term refugees are likely to convert their camps into permanent settlements, solidifying the environmental damage. This is a (continuing) concern in eastern Congo, where highly concentrated refugee settlements have led to the denuding of forests and to unsustainable bushmeat hunting. (The contrary case, when refugees disperse, is not well studied.)

Another effect occurs when a displaced group moves to territory that differs ecologically from the group's original habitat, e.g., Ethiopian pastoralists moving to agricultural land or nomadic herders moving into forests (Byers, 1991). A study on Rwanda showed that pastoral people will bring their animals and clear forests for grazing land. A study of Afghans in Pakistan showed that refugees from agricultural areas, if settled in forests, will clear forests for agriculture, even when this is an inherently unsuitable economic activity. Studies comparing different camp locations within the same country – Afghans in Pakistan, Rwandans in the eastern Congo – show that settling refugees in barren land and at considerable distance from forests will keep the forests safe from intrusion. But this imposes greater pressure and cost on relief organizations.

When refugees flee, wildlife in the home area should recover. That is the impression given in the Afghan, Nicaraguan, and Angolan cases (e.g., Sogge, 1992), and, to a lesser degree, in the Rwandan case. For Angola and for the former Yugoslavia, it has been noted that environmental problems appeared to lessen as a result of reduced economic activity due to war or to economic sanctions applied prior to war.

Another topic concerns the biodiversity impact of returning refugees. A study on

Mozambique stated with some certainty that adverse wildlife effects were closely correlated with the return path of refugees. Reopened highways and transportation corridors served as encroachment vectors and led to widespread wildlife slaughter (Hatton, Couto, and Oglethorpe, 2001).

Conservation in war

One victim of war is countries' reduced institutional capacity to protect nature and natural resources. Warfare prevents countries from carrying out their normal environmental protective duties. For example, serious soil erosion in the northern Ethiopian highlands in the 1980s was not caused by warfare but by government's attention being diverted to the civil war (Ståhl, 1989). Conservation by default means conservation neglect. Finances are redirected; staff go unpaid; habitats lose their protected status; equipment is stolen; facilities are looted; installations are destroyed; grounds are invaded; flora trampled; animals poached; research records lost; and achievements reversed. However, apart from scattered instances of specific threats to specific species, we do not know much about the ecological nature of these effects.

Humanitarian relief agencies, conservation organizations, and economic development programs, can work at cross-purposes. Following the Rwandan war in 1994 representatives of conservation groups took umbrage at humanitarian relief workers who appeared oblivious to the conservation value of nonhuman life and made injudicious refugee camp settlement decisions. Once an emergency has started and aid workers are overwhelmed with hundreds of thousands of people to care for, it is usually too late to do much about conservation. The key is in preparedness planning. After the Rwandan crisis, UNHCR, the U.N. refugee agency, drafted new policy documents with regard to the natural environment (UNHCR, 1996, 1998, 2001), but implementation is subject to the relevant authorities in refugee receiving countries. They have

their own location priorities.

Return to peace after war can be accompanied by resource concessions made in an unsettled natural-resource policy environment. In Mozambique, concessions were granted by different government agencies, influenced by corruption, without local consultation, and without coordination among government offices, granted even for protected areas that previously had been declared off-limits (Hatton, Couto, and Oglethorpe, 2001). It was not until 1997, five years after the end of the war, that a framework environmental law was passed by the national legislature. Enforcement is another matter.

Benefits of war, costs of peace

War does not always affect nature adversely. An oft-cited example is that of the Korean Demilitarized Zone (DMZ) and the Civilian Control Zone (CCZ), a 5 to 20 km-wide zone south of the DMZ in which commercial encroachment is limited. These zones have become a haven for rare and endangered species and constitute a unique wildlife habitat ranging across the entire east-west landscape of the Korean peninsula (Kim, 1997).

As mentioned, when war moves or decimates human populations or reduces their economic activity, wildlife can recuperate. The Spanish invasion of Panama in the 1500s killed large numbers of the local population, and farm and grassland reverted to dense forest (Bennett, 1968). Structures built for war can serve as artificial habitats. Artificial reefs seeded by sunken warships and warplanes are a common example. A 30 km-long system of extensive underground reinforced concrete tunnels dug in World War II by German troops in western Poland now houses northern Europe's largest collection of hibernating bats, at least 20,000 bats of 12 species, many of them rare or endangered.

An important subset of the literature observes that the military is among the most

important protectors of land, sea, and airspaces. Subjecting space to its exclusive use, the military unwittingly protects vast areas from agricultural or other forms of encroachment that have destroyed wilderness places elsewhere. For example, to secure park borders the U.S. Army was given sole protective control over Yellowstone National Park from 1886 to 1918 (Byers, 1994).

The converse of military activity benefitting nature is that of destructive peace. The Vietnam War may have left the natural environment in Vietnam, Cambodia, and Laos in tatters, but comparisons with relatively war-unaffected neighboring countries such as Burma, Indonesia, Malaysia, and Thailand show that the natural environment in the latter set of countries is now more damaged than it is in the former (Audubon, 1991).

The peace that follows war is a time of high vulnerability for nature. Bushmeat hunting in Liberia increased drastically after the war. In Mozambique, wildlife slaughter appeared to follow the route charted by the reopening of roads. In Burma, the government's arrangements with various ethnic groups allows all of them to rape the forest. What humans call war or peace is irrelevant from the point of view of nature. For nature, both can be destructive.

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