**Tragedy of the commons**

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The **tragedy of the commons** is a dilemma arising from the situation in which multiple individuals, acting independently and rationally consulting their own self-interest, will ultimately deplete a shared limited resource even when it is clear that it is not in anyone's long-term interest for this to happen. This dilemma was first described in an influential article titled "The Tragedy of the Commons," written by [Garrett Hardin](http://en.wikipedia.org/wiki/Garrett_Hardin) and first published in the journal [*Science*](http://en.wikipedia.org/wiki/Science_%28journal%29) in 1968.[[1]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-hardin68-0)

Hardin's Commons Theory is frequently cited to support the notion of sustainable development, meshing economic growth and environmental protection, and has had an effect on numerous current issues, including the debate over [global warming](http://en.wikipedia.org/wiki/Global_warming).

Central to Hardin's article is an example (first sketched in an 1833 pamphlet by [William Forster Lloyd](http://en.wikipedia.org/wiki/William_Forster_Lloyd)) of a hypothetical and simplified situation based on medieval land tenure in Europe, of herders sharing a common parcel of land, on which they are each entitled to let their cows graze. In Hardin's example, it is in each herder's interest to put the next (and succeeding) cows he acquires onto the land, even if the quality of the common is temporarily or permanently damaged for all as a result, through over grazing. The herder receives all of the benefits from an additional cow, while the damage to the common is shared by the entire group. If all herders make this individually rational economic decision, the common will be depleted or even destroyed to the detriment of all.

A similar dilemma of the [commons](http://en.wikipedia.org/wiki/The_commons) had previously been discussed by agrarian reformers since the 18th century.[[2]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-Rad-1) Hardin's predecessors used the alleged tragedy, as well as a variety of examples from the Greek Classics, to justify the [enclosure](http://en.wikipedia.org/wiki/Enclosure) movement. German historian [Joachim Radkau](http://en.wikipedia.org/wiki/Joachim_Radkau) sees Garrett Hardin's writings as having a different aim in that Hardin asks for a strict management of common goods via increased government involvement or/and international regulation bodies.[[2]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-Rad-1)

Hardin's work has been criticised on the grounds of historical inaccuracy, and for failing to distinguish between [common property](http://en.wikipedia.org/wiki/Common-pool_resource) and [open access](http://en.wikipedia.org/wiki/Open_access_%28infrastructure%29) resources. Subsequent work by [Elinor Ostrom](http://en.wikipedia.org/wiki/Elinor_Ostrom) and others suggest that using Hardin's work to argue for privatization of resources is an "overstatement" of the case.[[3]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-2)[[4]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-3) Nonetheless, Ostrom recognizes that there are real problems, and even limited situations where the tragedy of the commons applies to real-world resource management.[[5]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-urlOstrom_revisits_the_commons_in_Science-4)

As Hardin acknowledged [[6]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-Hardin92-5) there was a fundamental mistake in the use of the term “commons." This was already noted in 1975 by Ciriacy-Wantrup & Bishop (1975: 714) [[7]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-Ciriacy-6) who wrote that we "are not free to use the concept 'common property resources' or 'commons' under conditions where no institutional arrangements exist. Common property is not 'everybody's property' (...). To describe unowned resource (res nullius) as common property (res communes), as many economists have done for years (...) is a selfcontradiction." Neglecting the difference between common property and open access resources is a major reason of confusion in the debate that followed the 1968 Hardin's article.

**History of the idea**

**References to the Greek classics**

[Thucydides](http://en.wikipedia.org/wiki/Thucydides) (ca. 460 BC-ca. 395 BC) stated: "[T]hey devote a very small fraction of time to the consideration of any public object, most of it to the prosecution of their own objects. Meanwhile each fancies that no harm will come to his neglect, that it is the business of somebody else to look after this or that for him; and so, by the same notion being entertained by all separately, the common cause imperceptibly decays."[[8]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-7)

[Aristotle](http://en.wikipedia.org/wiki/Aristotle) (384-322 BC) similarly argued against common goods of the [*polis*](http://en.wikipedia.org/wiki/Polis) of [Athens](http://en.wikipedia.org/wiki/History_of_Athens): "That all persons call the same thing mine in the sense in which each does so may be a fine thing, but it is impracticable; or if the words are taken in the other sense, such a unity in no way conduces to harmony. And there is another objection to the proposal. For that which is common to the greatest number has the least care bestowed upon it. Every one thinks chiefly of his own, hardly at all of the common interest; and only when he is himself concerned as an individual. For besides other considerations, everybody is more inclined to neglect the duty which he expects another to fulfill; as in families many attendants are often less useful than a few."[[9]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-Aristotle-8)

**Later commentary**

In the 16th century [School of Salamanca](http://en.wikipedia.org/wiki/School_of_Salamanca), [Luis de Molina](http://en.wikipedia.org/wiki/Luis_de_Molina) observed that individual owners take better care of their goods than they do of common property.

More recently, [William Forster Lloyd](http://en.wikipedia.org/wiki/William_Forster_Lloyd) noted the comparison with medieval village land holding in his 1833 book on population.[[10]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-9)

Such a notion is not merely an abstraction, but its consequences have manifested literally in such common grounds as the [Boston Common](http://en.wikipedia.org/wiki/Boston_Common), where [overgrazing](http://en.wikipedia.org/wiki/Overgrazing) led to discontinuation of the common's use as public grazing ground.[[11]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-10) Radkau gives further, more positive examples and alleges the "real tragedy of the commons" to be ruthless use of common land motivated by agrarian reforms.[[2]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-Rad-1)

**Garrett Hardin's essay**

**Summary**

At the beginning of his essay, Hardin draws attention to problems that cannot be solved by technical means, i.e., as distinct from those with solutions that require "a change only in the techniques of the [natural sciences](http://en.wikipedia.org/wiki/Natural_science), demanding little or nothing in the way of change in [human values](http://en.wikipedia.org/wiki/Value_%28personal_and_cultural%29) or ideas of [morality](http://en.wikipedia.org/wiki/Morality)". Hardin contends that this class of problems includes many of those raised by human population growth and the use of the Earth's [natural resources](http://en.wikipedia.org/wiki/Natural_resource).

To make the case for "no technical solutions," Hardin notes the limits placed on the availability of energy (and material resources) on [Earth](http://en.wikipedia.org/wiki/Earth), and also the consequences of these limits for "[quality of life](http://en.wikipedia.org/wiki/Quality_of_life)." To maximize population, one needs to minimize resources spent on anything other than simple survival, and *vice versa*. Consequently, he concludes that there is no foreseeable technical solution to increasing both human populations and their [standard of living](http://en.wikipedia.org/wiki/Standard_of_living) on a finite planet.

From this point, Hardin switches to non-technical or resource management solutions to population and resource problems. As a means of illustrating these, he introduces a hypothetical example of a [pasture](http://en.wikipedia.org/wiki/Pasture) shared by local [herders](http://en.wikipedia.org/wiki/Herder), which he calls a commons. The herders are assumed to wish to maximize their yield, and so will increase their herd size whenever possible. The utility of each additional animal has both a positive and negative component:

* **Positive**: the herder receives all of the proceeds from each additional animal.
* **Negative**: the pasture is slightly degraded by each additional animal.

Crucially, division of these costs and benefits is unequal: the individual herder gains all of the advantage, but the disadvantage is shared among all herders using the pasture. Consequently, for an individual herder the rational course of action is to continue to add additional animals to his or her herd. However, since all herders reach the same rational conclusion, [overgrazing](http://en.wikipedia.org/wiki/Overgrazing) with immediate losses occurs, and degradation of the pasture may be its long-term fate. Nonetheless, the rational response for an individual remains the same at every stage, since the gain is always greater to each herder than the individual share of the distributed cost. The overgrazing cost here is an example of an [externality](http://en.wikipedia.org/wiki/Externality).

Because this sequence of events follows predictably from the behavior of the individuals concerned, Hardin describes it as a "tragedy."

In the course of his essay, Hardin develops the theme, drawing in examples of latter day "commons," such as the atmosphere, oceans, rivers, [fish stocks](http://en.wikipedia.org/wiki/Fish_stocks), [national parks](http://en.wikipedia.org/wiki/National_park), [advertising](http://en.wikipedia.org/wiki/Advertising), and even [parking meters](http://en.wikipedia.org/wiki/Parking_meter). The example of fish stocks had led some to call this the "tragedy of the fishers."[[12]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-11) A major theme running throughout the essay is the growth of human populations, with the [Earth](http://en.wikipedia.org/wiki/Earth)'s resources being a general common.

The essay also addresses potential [management](http://en.wikipedia.org/wiki/Management) solutions to commons problems including [privatization](http://en.wikipedia.org/wiki/Privatization), [polluter pays](http://en.wikipedia.org/wiki/Polluter_Pays), and [regulation](http://en.wikipedia.org/wiki/Regulation). Keeping with his original pasture analogy, Hardin categorizes these as effectively the "[enclosure](http://en.wikipedia.org/wiki/Enclosure)" of commons, and notes a historical progression from the use of all resources as commons (unregulated access to all) to systems in which commons are "enclosed" and subject to differing methods of regulated use in which access is prohibited or controlled. Hardin argues against relying on [conscience](http://en.wikipedia.org/wiki/Conscience) as a means of policing commons, suggesting that this favors selfish individuals – often known as [free riders](http://en.wikipedia.org/wiki/Free_rider_problem) – over those who are more altruistic.

In the context of avoiding [over-exploitation](http://en.wikipedia.org/wiki/Over-exploitation) of [common resources](http://en.wikipedia.org/wiki/Common-pool_resource), Hardin concludes by restating [Hegel](http://en.wikipedia.org/wiki/Georg_Wilhelm_Friedrich_Hegel)'s [maxim](http://en.wikipedia.org/wiki/Maxim_%28saying%29) (which was quoted by [Engels](http://en.wikipedia.org/wiki/Friedrich_Engels)), "freedom is the recognition of necessity." He suggests that "freedom" completes the tragedy of the commons. By recognizing resources as commons in the first place, and by recognizing that, as such, they require management, Hardin believes that humans "can preserve and nurture other and more precious freedoms."

Aside from its subject matter (resource use), the essay is notable (at least in modern scientific circles) for explicitly dealing with issues of [morality](http://en.wikipedia.org/wiki/Morality), and doing so in one of the [scientific community](http://en.wikipedia.org/wiki/Scientific_community)'s premier journals, [*Science*](http://en.wikipedia.org/wiki/Science_%28journal%29)*.* Indeed, the subtitle for the essay is "The population problem has no technical solution; it requires a fundamental extension in morality."

**Meaning**

The metaphor illustrates the argument that free access and unrestricted demand for a finite resource ultimately reduces the resource through [over-exploitation](http://en.wikipedia.org/wiki/Over-exploitation), temporarily or permanently. This occurs because the benefits of exploitation accrue to individuals or groups, each of whom is motivated to maximize use of the resource to the point in which they become reliant on it, while the costs of the exploitation are borne by all those to whom the resource is available (which may be a wider class of individuals than those who are exploiting it). This, in turn, causes demand for the resource to increase, which causes the problem to snowball to the point that the resource is depleted (even if it retains a capacity to recover). The rate at which depletion of the resource is realized depends primarily on three factors: the number of users wanting to consume the common in question, the consumptiveness of their uses, and the relative robustness of the common.[[13]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-12)

Like [William Lloyd](http://en.wikipedia.org/wiki/William_Forster_Lloyd) and [Thomas Malthus](http://en.wikipedia.org/wiki/Thomas_Malthus) before him, Hardin was primarily interested in the problem of [human population growth](http://en.wikipedia.org/wiki/Overpopulation). In his essay he also focused on the use of larger (though still limited) resources such as the Earth's atmosphere and oceans, as well as pointing out the "negative commons" of pollution (i.e., instead of dealing with the deliberate privatization of a positive resource, a "negative commons" deals with the deliberate commonization of a negative cost, pollution).

As a [metaphor](http://en.wikipedia.org/wiki/Metaphor), the tragedy of the commons should not be taken too literally. The phrase is [shorthand](http://en.wikipedia.org/wiki/Shorthand) for a structural relationship and the consequences of that relationship, not a precise description of it. The "tragedy" should not be seen as tragic in the conventional sense, nor must it be taken as condemnation of the processes that are ascribed to it. Similarly, Hardin's use of "commons" has frequently been misunderstood, leading Hardin to later remark that he should have titled his work "The Tragedy of the Unregulated Commons".[[14]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-13)

The tragedy of the commons has particular relevance in analyzing behavior in the fields of [economics](http://en.wikipedia.org/wiki/Economics), [evolutionary psychology](http://en.wikipedia.org/wiki/Evolutionary_psychology), [game theory](http://en.wikipedia.org/wiki/Game_theory), [politics](http://en.wikipedia.org/wiki/Politics), [taxation](http://en.wikipedia.org/wiki/Taxation), and [sociology](http://en.wikipedia.org/wiki/Sociology). Some also see it as an example of [emergent behavior](http://en.wikipedia.org/wiki/Emergent_behavior), with the "tragedy" the outcome of individual interactions in a [complex system](http://en.wikipedia.org/wiki/Complex_system).

**Criticism**

Hardin's essay has been widely criticized. Public policy experts have argued that Hardin's account of the breakdown of common grazing land was inaccurate, and that such commons were effectively managed to prevent overgrazing.[[15]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-urlSpringerLink_-_Journal_Article-14) Referring to Hardin's crucial passage on page 1244,17 [Partha Dasgupta](http://en.wikipedia.org/wiki/Partha_Dasgupta), for example, comments that "it is difficult to find a passage of comparable length and fame that contains so many errors as the one quoted." [[16]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-urlwww.econ.cam.ac.uk-15)

More significantly, criticism has been fueled by the application of Hardin's ideas to current policy issues. In particular, some authorities have read Hardin's work as specifically advocating the privatization of commonly owned resources. Consequently, resources that have traditionally been managed communally by local organizations have been [enclosed](http://en.wikipedia.org/wiki/Enclosure) or [privatized](http://en.wikipedia.org/wiki/Privatization). Ostensibly, this serves to protect such resources, but it ignores the pre-existing management, often appropriating resources and alienating indigenous (and frequently poor) populations. In effect, private or state use may result in worse outcomes than the previous management of commons.[[17]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-16)

Some of this controversy stems from disagreement over whether individuals will always behave in the selfish fashion posited by Hardin. Others[[18]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-17) have argued that even self-interested individuals will often find ways to cooperate, because collective restraint serves both the collective and individual interests. Hardin's piece has also been criticised as promoting the interests of Western economic ideology. G. N. Appell, an anthropologist, states: "Hardin's claim has been embraced as a sacred text by scholars and professionals in the practice of designing futures for others and imposing their own economic and environmental rationality on other social systems of which they have incomplete understanding and knowledge."[[19]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-18)

Hardin's advocacy of clearly defined property rights has frequently been used as an argument for privatization, or private property, *per se.* The opposite situation to a tragedy of the commons is sometimes referred to as a [tragedy of the anticommons](http://en.wikipedia.org/wiki/Tragedy_of_the_anticommons): a situation in which rational individuals (acting separately) collectively waste a given resource by under-utilizing it.

**Application**

**Modern commons**

The *tragedy of the commons* can be considered in relation to environmental issues such as [sustainability](http://en.wikipedia.org/wiki/Sustainability). The commons dilemma stands as a model for a great variety of resource problems in society today, such as water, land, fish, and [non-renewable energy](http://en.wikipedia.org/wiki/Non-renewable_energy) sources such as oil and coal.

Situations exemplifying the "tragedy of the commons" include the overfishing and destruction of the [Grand Banks](http://en.wikipedia.org/wiki/Grand_Banks), the destruction of [salmon](http://en.wikipedia.org/wiki/Salmon) runs on rivers which have been dammed – most prominently in modern times on the [Columbia River](http://en.wikipedia.org/wiki/Columbia_River) in the [Northwest United States](http://en.wikipedia.org/wiki/Northwest_United_States), and historically in [North Atlantic](http://en.wikipedia.org/wiki/North_Atlantic) rivers – the devastation of the sturgeon fishery – in modern Russia, but historically in the United States as well – and, in terms of water supply, the limited water available in arid regions (e.g., the area of the [Aral Sea](http://en.wikipedia.org/wiki/Aral_Sea)) and the [Los Angeles](http://en.wikipedia.org/wiki/Los_Angeles) water system supply, especially at [Mono Lake](http://en.wikipedia.org/wiki/Mono_Lake) and [Owens Lake](http://en.wikipedia.org/wiki/Owens_Lake).

Other situations exemplifying the "tragedy of the commons" include [pollution](http://en.wikipedia.org/wiki/Pollution) caused by driving cars. There are many negative [externalities](http://en.wikipedia.org/wiki/Externality) of driving; these include [congestion](http://en.wikipedia.org/wiki/Traffic_congestion), [carbon emissions](http://en.wikipedia.org/wiki/Carbon_emissions), and traffic accidents. For example, every time 'Person A' gets in a car, it becomes more likely that 'Person Z' – and millions of others – will suffer in each of those areas.[[20]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-19)

More general examples (some alluded to by Hardin) of potential and actual tragedies include:

Clearing rainforest for agriculture in southern Mexico.

* Planet [Earth](http://en.wikipedia.org/wiki/Earth) [ecology](http://en.wikipedia.org/wiki/Ecology)
  + Uncontrolled human [population growth](http://en.wikipedia.org/wiki/Population_growth) leading to [overpopulation](http://en.wikipedia.org/wiki/Overpopulation).[[1]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-hardin68-0)
  + [Air](http://en.wikipedia.org/wiki/Air), whether ambient air polluted by industrial emissions and cars among other sources of [air pollution](http://en.wikipedia.org/wiki/Air_pollution), or [indoor air](http://en.wikipedia.org/wiki/Indoor_air_quality).
  + [Water](http://en.wikipedia.org/wiki/Water) - [Water pollution](http://en.wikipedia.org/wiki/Water_pollution), [Water crisis](http://en.wikipedia.org/wiki/Water_crisis) of over-extraction of groundwater and wasting water due to [overirrigation](http://en.wikipedia.org/wiki/Irrigation#Problems_in_irrigation)[[21]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-20)
  + [Forests](http://en.wikipedia.org/wiki/Forests) - Frontier [logging](http://en.wikipedia.org/wiki/Logging) of [old growth forest](http://en.wikipedia.org/wiki/Old_growth_forest) and [slash and burn](http://en.wikipedia.org/wiki/Slash_and_burn)[[22]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-21)
  + [Energy resources](http://en.wikipedia.org/wiki/Energy_resources) and [climate](http://en.wikipedia.org/wiki/Climate) - Burning of [fossil fuels](http://en.wikipedia.org/wiki/Fossil_fuels) and consequential [global warming](http://en.wikipedia.org/wiki/Global_warming)
  + [Animals](http://en.wikipedia.org/wiki/Animal) - [Habitat](http://en.wikipedia.org/wiki/Habitat) destruction and [poaching](http://en.wikipedia.org/wiki/Poaching) leading to the [Holocene mass extinction](http://en.wikipedia.org/wiki/Holocene_extinction_event)[[23]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-22)
  + [Oceans](http://en.wikipedia.org/wiki/Oceans) - [Overfishing](http://en.wikipedia.org/wiki/Overfishing)[[24]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-23)[[25]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-24)
* Publicly Shared Resources
  + [Radio frequencies](http://en.wikipedia.org/wiki/Radio_frequencies) - Unlicensed frequencies used for wireless communications, especially [802.11](http://en.wikipedia.org/wiki/802.11) a/b/g in the U.S., detailed under [Part 15 (FCC rules)](http://en.wikipedia.org/wiki/Part_15_%28FCC_rules%29) would be vulnerable to the overuse of high power [transmitters](http://en.wikipedia.org/wiki/Transmitters), especially overdriven transmitters with dirty signal profiles, and especially when combined with [omnidirectional](http://en.wikipedia.org/wiki/Omnidirectional_antenna) [antennas](http://en.wikipedia.org/wiki/Antennas)[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)], had the FCC not mandated maximum transmission power for each class of device and limitations on their spectral profile.
  + [Spam email](http://en.wikipedia.org/wiki/Spam_%28electronic%29) degrades the usefulness of the email system and increases the cost for all users of the Internet while providing a benefit to only a tiny number of individuals.
  + [Vandalism](http://en.wikipedia.org/wiki/Vandalism) and [littering](http://en.wikipedia.org/wiki/Litter) in public spaces such as [Public restrooms](http://en.wikipedia.org/wiki/Public_restroom), [parks](http://en.wikipedia.org/wiki/Park) and [recreation areas](http://en.wikipedia.org/wiki/Recreation_area).

**Modern solutions**

Articulating solutions to the tragedy of the commons is one of the main problems of [political philosophy](http://en.wikipedia.org/wiki/Political_philosophy). In absence of [enlightened self-interest](http://en.wikipedia.org/wiki/Enlightened_self-interest), some form of authority or federation is needed to solve the collective action problem. In a typical example, governmental regulations can limit the amount of a common good available for use by any individual. Permit systems for extractive economic activities including mining, fishing, hunting, livestock raising and timber extraction are examples of this approach. Similarly, limits to pollution are examples of governmental intervention on behalf of the commons. Alternatively, resource users themselves can cooperate to conserve the resource in the name of mutual benefit.

Another solution for certain resources is to convert common good into private property, giving the new owner an incentive to enforce its sustainability. Effectively, this is what took place in the English [Inclosure Acts](http://en.wikipedia.org/wiki/Inclosure_Acts). Increasingly, many agrarian studies scholars advocate studying traditional commons management systems to understand how common resources can be protected without alienating those whose livelihoods depend upon them.

An opposing idea, used by the [United Nations](http://en.wikipedia.org/wiki/United_Nations) [Moon Treaty](http://en.wikipedia.org/wiki/Moon_Treaty), [Outer Space Treaty](http://en.wikipedia.org/wiki/Outer_Space_Treaty) and [Law of the Sea Treaty](http://en.wikipedia.org/wiki/Law_of_the_Sea_Treaty) as well as the [UNESCO](http://en.wikipedia.org/wiki/UNESCO) [World Heritage Convention](http://en.wikipedia.org/wiki/World_Heritage_Convention) involves the international law principle which designates certain areas or resources the [Common Heritage of Mankind](http://en.wikipedia.org/wiki/Common_Heritage_of_Mankind).[[26]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-25)

[Libertarians](http://en.wikipedia.org/wiki/Libertarianism) and [classical liberals](http://en.wikipedia.org/wiki/Classical_liberalism) often cite the tragedy of the commons as an example of what happens when [Lockean](http://en.wikipedia.org/wiki/John_Locke) property rights to homestead resources are prohibited by a government.[[27]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-26)[[28]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-27)[[29]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-28) These people argue that the solution to the tragedy of the commons is to allow individuals to take over the property rights of a resource, that is, privatizing it.[[30]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-29) In 1940 [Ludwig von Mises](http://en.wikipedia.org/wiki/Ludwig_von_Mises) wrote concerning the problem:

If land is not owned by anybody, although legal formalism may call it public property, it is used without any regard to the disadvantages resulting. Those who are in a position to appropriate to themselves the returns — lumber and game of the forests, fish of the water areas, and mineral deposits of the subsoil — do not bother about the later effects of their mode of exploitation. For them, erosion of the soil, depletion of the exhaustible resources and other impairments of the future utilization are external costs not entering into their calculation of input and output. They cut down trees without any regard for fresh shoots or reforestation. In hunting and fishing, they do not shrink from methods preventing the repopulation of the hunting and fishing grounds.[[31]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-30)

Critics of this solution have pointed out that many commons, such as the ozone layer or global fish populations, would be extremely difficult or impossible to privatize.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

Psychologist [Dennis Fox](http://en.wikipedia.org/w/index.php?title=Dennis_Fox&action=edit&redlink=1) used a number, what is now termed "[Dunbar's number](http://en.wikipedia.org/wiki/Dunbar%27s_number)", to take a new look at the tragedy of the commons. In a 1985 paper titled ["Psychology, Ideology, Utopia, & the Commons"](http://www.dennisfox.net/papers/commons.html), he stated "Edney (1980, 1981a) also argued that long-term solutions will require, among a number of other approaches, breaking down commons into smaller segments. He reviewed experimental data showing that cooperative behavior is indeed more common in smaller groups. After estimating that "the upper limit for a simple, self-contained, sustaining, well-functioning commons [sic] may be as low as 150 people" (1981a, p. 27).

[Costa Rica](http://en.wikipedia.org/wiki/Costa_Rica) has successfully advanced the growth of its ecotourism business by taking account of, and pricing for, the environmental business services consumed by pollution.[[32]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-31) The [Coast Salish](http://en.wikipedia.org/wiki/Coast_Salish) managed their natural resources in a place-based system in which families were responsible for looking after a place and its resources.[[33]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-32) Access to food was the major source of wealth and the empowerment of generosity was highly valued, so it made sense for them to take care of the resources.

The "[Coasian](http://en.wikipedia.org/wiki/Coase_theorem)" solution to the problem is also a popular one, whereby the people formerly using the common each gain their own individual part of it instead - so it is no longer a common - and do not have to support one another so as not to deplete the resource.

In Hardin's essay, he proposed that the solution to the problem of overpopulation must be based on "mutual coercion, mutually agreed upon" and result in "relinquishing the freedom to breed". Hardin discussed this topic further in a 1979 book, *Managing the Commons,* co-written with [John A. Baden](http://en.wikipedia.org/wiki/John_A._Baden).[[34]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-33) He framed this prescription in terms of needing to restrict the "[reproductive right](http://en.wikipedia.org/wiki/Reproductive_rights)" in order to safeguard all other [rights](http://en.wikipedia.org/wiki/Rights). Only one large country has adopted this policy, the [People's Republic of China](http://en.wikipedia.org/wiki/People%27s_Republic_of_China). In the essay, Hardin had rejected education as an effective means of stemming population growth. Since that time, it has been shown that increased educational and economic opportunities for women correlates well with reduced birthrates in most countries, as does economic growth in general. However, given the nature of the problem as a limit to a given common resource, economic growth resulting in a higher per capita use of the resource may more than offset the decreased population growth's effect on total resource consumption.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

**Application to evolutionary biology**

The *tragedy of the commons* is referred to in studies of [evolutionary biology](http://en.wikipedia.org/wiki/Evolutionary_biology), [social evolution](http://en.wikipedia.org/wiki/Social_evolution), [sociobiology](http://en.wikipedia.org/wiki/Sociobiology) and [behavioral ecology](http://en.wikipedia.org/wiki/Behavioral_ecology). A tragedy of the commons is brought about by selfish individuals whose [genes](http://en.wikipedia.org/wiki/Genes) for selfish behaviour would therefore come to predominate, so the metaphor cannot explain how [altruism](http://en.wikipedia.org/wiki/Altruism) arises. This question is addressed instead by models of possible mechanisms that can give rise to "[reciprocal altruism](http://en.wikipedia.org/wiki/Reciprocal_altruism)", leading to ideas like the "[tit for tat](http://en.wikipedia.org/wiki/Tit_for_tat)" rule (reciprocation). These models freed evolutionary theory from the limitations imposed by the concept of "[inclusive fitness](http://en.wikipedia.org/wiki/Inclusive_fitness)", a previous explanation for altruism, which proposed that organisms help others only to the extent that by doing so they increase the probability of passing shared genes to the next generation.

A parallel was drawn recently between the tragedy of the commons and the competing behaviour of parasites that through acting [selfishly](http://en.wikipedia.org/wiki/Gene-centered_view_of_evolution) eventually diminish or destroy their common host.[[35]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-34)

The idea has also been applied to areas such as the evolution of [virulence](http://en.wikipedia.org/wiki/Virulence) or [sexual conflict](http://en.wikipedia.org/wiki/Sexual_conflict), where males may fatally harm females when competing for matings.[[36]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-35) It is also raised as a question in studies of social insects, where scientists wish to understand why insect workers do not undermine the "common good" by laying eggs of their own and causing a breakdown of the society.

The idea of [evolutionary suicide](http://en.wikipedia.org/wiki/Evolutionary_suicide), where adaptation at the level of the individual causes the whole species or population to be driven [extinct](http://en.wikipedia.org/wiki/Extinct), can be seen as an extreme form of an evolutionary tragedy of the commons.[[37]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-36)[[38]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-37)

**The commons dilemma**

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| The *commons dilemma* is a specific class of [social dilemma](http://en.wikipedia.org/wiki/Social_dilemma) in which people's short-term selfish interests are at odds with long-term group interests and the [common good](http://en.wikipedia.org/wiki/Common_good). In academia, a range of related terminology has also been used as shorthand for the theory or aspects of it, including *resource dilemma*, *take-some dilemma*, and [*common pool resource*](http://en.wikipedia.org/wiki/Common_pool_resource).  Commons dilemma researchers have studied conditions under which groups and communities are likely to under- or [over-harvest](http://en.wikipedia.org/wiki/Over-harvest) common resources in both the laboratory and field. Research programs have concentrated on a number of motivational, strategic, and structural factors that might be conducive to management of commons.  In [game theory](http://en.wikipedia.org/wiki/Game_theory), which constructs mathematical models for individuals' behavior in strategic situations, the corresponding "game", developed by the ecologist [Garrett Hardin](http://en.wikipedia.org/wiki/Garrett_Hardin), is known as the Commonize Costs — Privatize Profits Game ([CC–PP game](http://en.wikipedia.org/wiki/CC%E2%80%93PP_game)).  **Motivational factors**  First, the research shows that some people are more [motivated](http://en.wikipedia.org/wiki/Motivation) than others to manage the common resource responsibly. Using the commons dilemma game, researchers found that people with "prosocial" value orientations harvest less from a resource during a period of scarcity. "Prosocial" individuals are also more inclined to engage in sustainable environmental behaviours such as taking public transport (instead of an automobile), conserving energy and water, and explaining their decisions in terms of environmental impact.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]  Motivation to conserve a common resource is also promoted by people’s group ties. When people identify with their group, they are more likely to exercise personal restraint, as well as compensate for greedy harvest decisions of ingroup members more so than outgroup members.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] Similarly, in the field, strongly knit communities are usually better at managing resource shortages than communities with weak social ties. Group identity may promote a long-term perspective on resource management, which makes it easier for people to sacrifice their immediate interest on behalf of their local community. Group identification may also increase the social interdependencies between community members, so that they care more for the social rewards and punishments of their community.  The state of the common resource can also shape motivations. Research has manipulated the reasons that people were given for resource overuse. When greedy people were seen as causing the depletion, participants were more greedy than when there was deemed to be a natural cause (such as a sudden drought). Resource uncertainty further contributes to [over-harvesting](http://en.wikipedia.org/wiki/Over-harvesting). In commons dilemmas, uncertainty about the pool size tends to increase individual harvesting and expectations about how much other people harvest. When there is uncertainty, people overestimate the size of the resource and perceive greater variability in how much other people take. Similarly, uncertainty about the replenishment rate of the pool also increases harvesting. The most likely explanation is that people have an optimistic bias. In the fisheries example, each individual prefers to maximize their profits by fishing without limits. However, it is better for the group as a whole if everyone limits how much they fish so that there will be enough fish next year.[[39]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-38)  **Strategic factors**  [Strategic](http://en.wikipedia.org/wiki/Strategy) factors also matter in commons dilemmas. One often-studied strategic factor is the order in which people take harvests from the resource. In simultaneous play, all people harvest at the same time, whereas in sequential play people harvest from the pool according to a predetermined sequence – first, second, third, etc. There is a clear order effect in the latter games: the harvests of those who come first – the leaders – are higher than the harvest of those coming later – the followers. The interpretation of this effect is that the first players feel entitled to take more. With sequential play, individuals adopt a first come-first served rule, whereas with simultaneous play people may adopt an equality rule. Another strategic factor is the ability to build up reputations. Research found that people take less from the common pool in public situations than in anonymous private situations. Moreover, those who harvest less gain greater prestige and influence within their group.  **Structural factors**  Much research has focused on when and why people would like to structurally rearrange the commons to prevent a tragedy. Hardin stated in his analysis of the tragedy of the commons that "Freedom in a commons brings ruin to all".[[40]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-39) One of the proposed solutions is to appoint a leader to regulate access to the common. Groups are more likely to endorse a leader when a common resource is being depleted and when managing a common resource is perceived as a difficult task. Groups prefer leaders who are elected, democratic, and prototypical of the group, and these leader types are more successful in enforcing cooperation. There is a general aversion against autocratic [leadership](http://en.wikipedia.org/wiki/Leadership), although it may be an effective solution, possibly because of the fear of power abuse and corruption.  Another structural solution is the [privatization](http://en.wikipedia.org/wiki/Privatization) of the commons, which has been very effective in experimental and field research.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] However, privatization raises concerns about social justice, as not everyone may be able to get an equal share; also, Darwinian systems tend to evoke sympathetic responses that lead to the artificial support of those who actually weaken the system itself.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] It also may erode people's personal and social motivations to cooperate in preserving a resource.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]  The provision of rewards and punishments may also be effective in preserving common resources. Selective punishments for overuse can be effective in promoting domestic water and energy conservation – for example, through installing water and electricity meters in houses. Selective rewards work provided that they are open to everyone. An experimental carpool lane in the Netherlands failed because car commuters did not feel they were able to organize a carpool.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]The rewards do not have to be tangible. In Canada there is a movement to put 'smiley faces' on electricity bills if you are below the average for your class.[[41]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-40) Much field research on commons dilemmas has combined solutions obtained in experimental research.[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] [Elinor Ostrom](http://en.wikipedia.org/wiki/Elinor_Ostrom), who was awarded 2009's Nobel Prize of Economics for her work on the issue, and her colleagues looked at how real-world communities manage communal resources, such as fisheries, land irrigation systems, and farmlands, and they identified a number of factors conducive to successful resource management. One factor is the resource itself; resources with definable boundaries (e.g., land) can be preserved much more easily. A second factor is resource dependence; there must be a perceptible threat of resource depletion, and it must be difficult to find substitutes. The third is the presence of a community; small and stable populations with a thick social network and social norms promoting conservation do better.[[42]](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_note-41) A final condition is that there are appropriate community-based rules and procedures in place with built-in incentives for responsible use and punishments for overuse.  **See also**   * [The commons](http://en.wikipedia.org/wiki/The_commons) * [Diner's dilemma](http://en.wikipedia.org/wiki/Diner%27s_dilemma) * [Enlightened self-interest](http://en.wikipedia.org/wiki/Enlightened_self-interest) * [Free rider problem](http://en.wikipedia.org/wiki/Free_rider_problem) * [Inverse commons](http://en.wikipedia.org/wiki/Inverse_commons) * [Khazzoom–Brookes postulate](http://en.wikipedia.org/wiki/Khazzoom%E2%80%93Brookes_postulate) * "[The Market for Lemons](http://en.wikipedia.org/wiki/The_Market_for_Lemons)" * [Overexploitation](http://en.wikipedia.org/wiki/Overexploitation) * [Population control](http://en.wikipedia.org/wiki/Population_control) * [Race to the bottom](http://en.wikipedia.org/wiki/Race_to_the_bottom) * [Social dilemma](http://en.wikipedia.org/wiki/Social_dilemma) * [Social trap](http://en.wikipedia.org/wiki/Social_trap) * [Tragedy of the anticommons](http://en.wikipedia.org/wiki/Tragedy_of_the_anticommons) * [Tyranny of small decisions](http://en.wikipedia.org/wiki/Tyranny_of_small_decisions)   **Notes**   * 1. ^ [***a***](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_ref-hardin68_0-0) [***b***](http://en.wikipedia.org/wiki/Tragedy_of_the_commons#cite_ref-hardin68_0-1) Garrett Hardin, ["The Tragedy of the Commons"](http://www.sciencemag.org/cgi/content/full/162/3859/1243), *Science*, Vol. 162, No. 3859 (December 13, 1968), pp. 1243-1248. 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