

Driving along any major highway in the Southern United States, one cannot help but notice the strange green foliage that seems to blanket vast sections of the surrounding land. Millions of leaved vines crawl over steep cliffs and hills, dominate every meadow and field in sight, and wrap a never ending multitude of their tendrils around bushes, trees, even telephone poles (*Appendix A*). This rampantly growing vine is Kudzu, and it is a non- native invasive species of plant. The troublesome weed threatens to disrupt provisions of the ecosystems it plagues in several ways, including lowering the production of crops, eliminating the landscape for recreational activities such as hunting and fishing, and degrading the aesthetic value of areas that rely on tourism for income.

The history of the Kudzu vine in America is not only interesting; it displays why and how kudzu became the invasive force it is today. Kudzu was first brought to the United States in 1876 as a part of an ornamental garden showcase at the Philadelphia Centennial Exposition [1]. It grows naturally in China and Japan, where native insect species keep its expansion in check. Because of the vine's remarkably sturdy and adaptable root structure, it was used to combat erosion in the 1930s [1]. The Soil Conservation Services actually paid farmers from Mississippi and Alabama eight dollars per acre to plant kudzu on their land, causing it to cover over a million acres by 1942[1]. Eventually scientists and farmers alike realized that the same properties of kudzu that successfully combated soil erosion, namely fast growing and deep reaching masses of heavy tuberous roots, deemed the extraction of the plant a strenuous, if not impossible process. Kudzu now heavily infests huge swaths of the Southeastern United States as well as select portions of the Pacific Northwest, and is always spreading [1]. Lately it has even moved into Northeastern coast regions, although there are not severe infestations in that location yet (*Appendix B*), and covers 7.4 million acres in the United States [2].

Kudzu kills. Its leaves are large and trifoliate, covering the majority of the surface area of plants it grows over, effectually "smothering" them by blocking their absorption of sunlight and thus preventing them from photosynthesizing [4]. As plants die because they cannot compete with kudzu's rapid ability to photosynthesize and grow, a deadly chain reaction ensues. Plants that have symbiotic or mutualistic relationships with kudzu casualty plants die, and then animals that feed on these plants and rely on them for shelter begin to die as well. The fewer animals there are in the ecosystem, the fewer opportunities there are for propagation of seeds of already reduced native plant species by means such as dispersal through fecal matter.

Kudzu thrives in nitrogen rich soils because of its mutualism with rhizome inhabitant bacteria [4]. This same soil is most suitable for farms, allowing the kudzu vines to reach as far as 18 feet underground in areas designated as cropland. At such a dramatic depth, kudzu vines can access more water from the soil than native crops with shallower roots, adding to its ability to outcompete traditional flora species [4]. The smothering and dehydrating action of kudzu edging onto farms lowers average yields of goods. In addition to the financial burden placed on farmers for not selling as much product, the cost of eradication, should they choose to try and fight the kudzu, is an additional monetary strain at a steep estimate of \$48.00 per acre per year [1]. Considering kudzu covers a new 120,000 acres annually, the cumulative

cost of removal is only going to increase [2]. Although it sounds like a fact from a science fiction story, a mature kudzu vine is literally capable of collectively growing up to a foot a day, especially during summer, so the financial strain of kudzu shows no signs of letting up anytime soon [1]. In the 2010 Oregon Department of Agriculture Plant Pest Risk Assessment file, kudzu was rated on a scale of one to five in the various aspects of possible damages it could cause. In the economic category, kudzu earned a high score of four, on the grounds that it “demonstrates high potential to cause significant impact throughout analysis area resulting in reduced crop yield...increased cost of production or a loss of market due to contamination”[1].

Farming is just one industry that is threatened by kudzu disrupting the provisioning of ecosystem products. Recreational enterprises like hunting and fishing, are provisions of the ecosystem that kudzu threatens to extinguish as well. The reason is simple; as kudzu kills native plants, animals that rely on such plants for food and habitat can no longer survive, and hunting outfitters cannot realistically stay in business without animals for customers to hunt. An example of this phenomenon is evident in the comparison on data concerning what deer eat, and which plants kudzu kills. The Arkansas Game and Fish commission presents a detailed list of which plants comprise deer diet in which season (*Appendix C*), and the United States Federal Forest Service database charts the Society of American Foresters’ forest cover type classification of ecosystems (*Appendix D*). In spring alone, deer in the Southern United States rely on red maple, willow, red cedar, and sassafras for sustenance [6]. All of these plant species and several others are Society of American Foresters cover type species, proving that the very same plants that deer depend on for survival are destroyed by kudzu [3]. Turkey, waterfowl, and boar are other species among many that are hunted in the South in addition to deer. As the impact of kudzu species is evident in reducing deer food sources so dramatically, it is easy to imagine how these game populations would decrease in the same manner.

Overtime, the possible devastation of kudzu on forests could undoubtedly damage the freshwater stream ecosystems that originate within, by changing the overall composition of species present in the waters [1]. As of now, however, there are no directly documented ecological links between kudzu and aquatic ecosystems as there are between kudzu and affected land. Yet there is an undeniable reality that if kudzu continues to degrade the aesthetics of landscapes in the United States, tourism in the affected areas will decrease proportionally. Kudzu gained the nickname, “the vine that ate the South” for a reason. It covers over all vegetation in its path. Recreational fishing is therefore another industry that could financially suffer because of Kudzu. Vacationers hoping to fly fish in the peaceful backwoods streams of North Carolina, for instance, crave a setting with beautiful natural scenery, not a homogenous mass of green that engulfs a dying environment in every direction. Similarly, tourists do not desire to hike in kudzu infested forests, camp in clearings of kudzu, canoe in creeks surrounded by the insidious vine, or buy a vacation home that could have an unstoppable infestation of kudzu growing on its grounds by the time the residents return for their next stay.

In addition to the incalculable financial burden that would result from decreases in all aspects of the tourism industry, there is another reason kudzu may negatively affect tourism; new studies show that it contributes to ozone pollution in the atmosphere, which would lower air qualities of affected areas, making them less desirable destinations in general. Kudzu fixes nitrogen from the soil much more rapidly than native plants, causing microbes that live within its roots to release it as nitric oxide [2]. This pairs with nitrogen in the atmosphere to make ozone, which reacts with other molecules in the atmosphere to make smog, an air pollutant that negatively affects crops, forest growth, and human respiratory health [2]. The American Geophysical Union shockingly reports that scientists estimate a 30 percent increase in code red smog days per year in the next decade should kudzu growth continue to affect the atmosphere [2].

Kudzu is more than a nuisance to farmers, businesses that cater to wildlife enthusiasts and hunters, and tourist enterprises all over the Southern U.S. and parts of the Northwest. It imminently threatens the ecosystem services upon which their livelihoods depend. If kudzu infestation is truly to be rid of once and for all, the governments of affected states must establish large- scale intensive removal programs just as persistent as the plant's ever- growing vines. Individuals currently employ herbicide treatments, animal grazing, and burning measures in attempt to control and eradicate kudzu, but all of these removal practices have flaws. Herbicide treatments are not only costly, but cannot be used to eradicate the weed in one series of spraying. Application of the chemicals will often only kill the outer vines, not the roots, allowing the plant to easily regenerate, and the doses needed to kill kudzu are so strong that attempting to permanently wipe out an infestation in one spraying could be lethal to the applicator and soil in which the kudzu lives [5]. Since the whole purpose of eradicating kudzu is to reclaim the soil it covers and enable native plants or crops to regrow, it would be foolish to further ruin the soil by infusing it with copiously harmful amounts of chemicals. Even routine sprays to combat kudzu can damage soil over time. Picloram, for example, is a common herbicide used to fight kudzu that can "severely kill desirable non target plants" and "leach through sandy soils or be lost in surface water runoff and contaminate streams and groundwater"[5].

Animals can be used as grazers to continually feed on kudzu and curb its growth, but this method is also only capable of removing the outer leaved vines of kudzu as its roots continually expand underground, making it harder and harder to graze away every year. Raising cattle is such an expensive and demanding operation that it is an unrealistic responsibility to take on as a temporary solution to an underlying problem. Kudzu can be burned, but once again this only destroys vines and does not eliminate roots. Burning kudzu, in fact, actually promotes its growth in the long run, by hardening the seed pods present on the vines, making germination conditions more suitable [5]. Some individuals propose the introduction of non-native insect species to biologically combat the kudzu infestation, but the possible effects of this gamble could further devastate ecosystems. Some insects known to feed on kudzu in its natural Asian habitat are also known eaters of valuable American crops, such as soybeans [5]. The United States Department of Agriculture

Animal and Plant Health Inspection Service (APHIS), even states that “there are no species (of proposed insect predators) listed as present in the continental United States so we do not recommend any species for testing”[5].

The only way to truly eradicate a kudzu vine is by removing the root problem: the root! Kudzu reproduces by sending runner roots below ground to search for crown roots from which vines grow [4]. Kudzu crowns, which are about the size of a fist and store nutrients specifically for reproduction, are located farther underground the older the plant is [4]. Because all new growth stems from these burdensome bulbs, the crowns of kudzu vines must be unearthed, removed, and properly destroyed to prevent regrowth. If the crowns are simply discarded in a heap of dirt, or anywhere near soil or other plant material, kudzu can easily sprout runners and reestablish itself in a new location [4]. If state governments use tax funds, or possible grants from the federal government to set up huge kudzu digs, the weed can be removed by good old-fashioned labor. Pulling massive weeds out of the earth all day may sound unattractive, but in these economically depressed times, there are countless unemployed citizens who are willing to do anything to make a living. Their efforts could be combined with those of community service and environmentalist groups, who simply choose to dig for the good of the area and environment, and even misdemeanor criminals who might otherwise be assigned to pick up trash, or repaint fences.

If each affected state had just one center for kudzu eradication, they could hire a small number of scientists and analysts to assess kudzu eradication needs county by county. Sure, there would be substantial costs to pay workers, build centers for eradication, and supply their tools and transportation, but the amount of new jobs it could create both by immediately employing workers, and re-enabling farming, fishing, hunting and tourism enterprises to thrive, would be much more substantial. The United States government has a history of funding “bootstraps” labor such as the Work Projects Administration of the 1930s. There is no reason kudzu removal could not serve as a basis for a project of such scale. Besides, the plant itself does have some beneficial qualities that could potentially translate into monetary value. Harvard Medical School released a study demonstrating how it may help alcoholics control their drinking, and it contains the natural substance daidzein, which fights inflammatory and microbial infections, dilates coronary arteries, and relaxes muscles. Because kudzu crowns must be properly disposed of anyway, there is potential for the sale of unearthed kudzu to pharmaceutical companies across the United States, which could even help state run kudzu control operations to pay back start up costs [4].

Who knew that an ornamental garden showcase in 1876 could cause such ecological distress today? Kudzu invasion in the United States must be faced with a large-scale intensive digging program soon, or it will continue to threaten the affected areas’ ecosystem provisioning of farmed products, hunting and fishing industry, and the plethora of aesthetic concerns that make tourism viable in these places. Economic damage could increase, and ecological ruin could continue if the spread of the vine is not curbed. The “vine that ate the South” could become the vine that ate the United States.



## Appendix

A

Kudzu Covering Land, © John M. Randall/ The Nature Conservancy [4];



B

Oregon Department of Agriculture Map of States Affected by Kudzu [1];



C


Federal Forest Service Database of Society of American Foresters Forest Cover Type Ecosystems [4];

SAF COVER TYPES [[12](#)]:

- 17 Pin cherry
- 19 Gray birch-red maple
- 21 Eastern white pine
- 22 White pine-hemlock
- 23 Eastern hemlock
- 25 Sugar maple-beech-yellow birch
- 26 Sugar maple-basswood
- 27 Sugar maple
- 28 Black cherry-maple
- 33 Red spruce-balsam fir
- 37 Northern white-cedar
- 39 Black ash-American elm-red maple
- 40 Post oak-blackjack oak
- 42 Bur oak
- 43 Bear oak
- 44 Chestnut oak
- 45 Pitch pine
- 46 Eastern redcedar
- 50 Black locust
- 51 White pine-chestnut oak
- 52 White oak-black oak-northern red oak
- 53 White oak
- 55 Northern red oak
- 57 Yellow-poplar
- 58 Yellow-poplar-eastern hemlock
- 59 Yellow-poplar-white oak-northern red oak
- 60 Beech-sugar maple
- 61 River birch-sycamore
- 62 Silver maple-American elm
- 63 Cottonwood
- 64 Sassafras-persimmon

D

Arkansas Game and Fish Commission Listing of "What Deer Eat" [6].



# SPRING

Spring is "green-up" time when young, tender plants begin to grow, and food becomes more plentiful. Deer are often found around fields and wood lot openings where new spring growth initially begins.

### Woody Plants

Red maple	Hydrangea
Elm	Blueberry
Willow	Poison Ivy
Azalea	Greenbrier
Deerberry	Black gum
Blackberry	Grape
Red Cedar	New Jersey tea
Dogwood	Strawberry bush
Sassafras	Trumpet creeper
Honeysuckle	

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### Forbs

Dandelion	Violet
Spiderwort	Lespedeza
Trout lily	Wild clover
Aster	Fungi
Wild pea	Spring beauty
Wild Strawberry	Fleabane
Jewelweed	Trefoil

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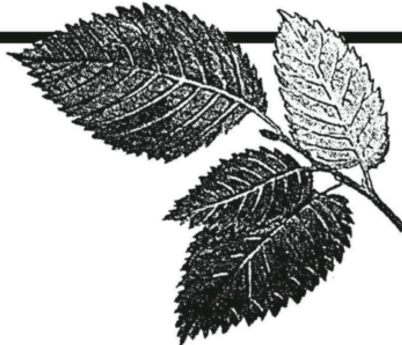
### Grasses

Annual Wild Grasses

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### Crops

Winter wheat	Clover
Annual rye grass	



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