Risks posed by the WECHAR (Water efficiency via Carbon Harvesting and Restoration) Bill

Followed by Separate Statement by three Scientists about Salt Cedars and the WECHAR Bill

Biofuelwatch, 3rd March 2010

What is the WECHAR Bill?

Water Efficiency via Carbon Harvesting and Restoration (WECHAR) Act of 2009 is a Bill proposed by Senator Reid of Nevada, cosponsored by Senators Baucus and Tester of Montana, Senator Hatch of Utah and Senator Udall of New Mexico.

The WECHAR Bill is the first bill specifically for biochar support and commercialisation proposed anywhere in the world.

The main provisions are:

- Federal Loan Guarantees, involving loans by private institutions, for commercial biochar developments and biochar demonstration projects using invasive plants and 'excess plant biomass' on public lands. The main feedstock will be tamarisks/salt cedars in the Mojave Desert, pinyon pine and juniper in the Great Basin and "excess biomass" including beetle-killed trees in the Intermountain West. The term 'excess biomass is defined as "any plant matter targeted for removal from public land to promote ecosystem health", including trees, tree waste, wood, wood waste, weedy plants and grasses;
- Guaranteed loans for a comprehensive Research & Development programme on biochar and pyrolysis;
- Requirement on the US Geological Survey to carry out resource assessments of invasive plant species and dangerous fuel load due to 'excess biomass and to estimate the carbon content of suitable feedstock. Other agencies required to be involved are the National Park Service, the Bureau of Land Management and the Forest Service.

Is federal support for biochar commercialisation justified in general?

It is claimed that biochar can help mitigate climate change by sequestering carbon and that it can help to improve soil fertility and reduce the use of synthetic fertilisers. It is also claimed that biochar can improve soil structures and water retention in soils.

However, those claims rely largely on laboratory studies and greenhouse studies, which often involve sterile soils, as well as on studies of *terra preta*. Terra preta is carbon-rich and highly fertile soil found in Central Amazonia. It was formed by indigenous farmers during a period 500-2500 years ago. Their farming methods are not fully understood, however it is known that they involved additions of highly diverse organic residues including as compost, manure, fish bones, turtle shells and river sediments as well as charcoal over a long period. There is a lack of peer-reviewed field studies and in particular long-term ones, i.e. ones lasting for a minimum of two years. Field-studies in soil science can be compared to clinical studies in medicine, without which no treatments and drugs can be approved.

The United Nations Environment Programme states the following: "Biochar is a new and poorly understood technology. Research is still at a preliminary stage and large-scale biochar deployment is inadvisable until these uncertainties are resolved... The impacts of large-scale biochar production on biodiversity and long-term agricultural sustainability (e.g. nutrient depletion) are unknown."[i]

Here is a summary of the main concerns about biochar:

Climate impacts:

Although some of the carbon contained in charcoal, black carbon, is known to remain in soils for thousands of years, it is not clear how much of the carbon will remain stable for how long. Furthermore, there is evidence that charcoal additions can boost soil microbes which turn existing soil carbon into CO2. Finally, airborne black carbon, in particular black soot, is a significant cause of global warming. Some biochar particles are as small as black soot particles from the outset; others become that small through degradation. Biochar particles can become airborne during biochar handling and application and also subsequently, through soil erosion.

Impacts on soil fertility:

The immediate impacts of biochar application differ according to the type of biochar used, soil type and crops grown. A spokesperson of the Australian Commonwealth and Scientific Research Organisation (CSIRO) has warned against biochar use by farmers in the absence of further research.[ii] CSIRO has published a detailed review of the scientific literature about biochar[iii] and has been awarded funding for further research. The lack of long-term field studies means that little data is available about longer-term biochar impacts on soil fertility, however it is known that biochar is not a fertiliser and cannot maintain soil fertility without additional fertilisers being used beyond a short initial period. On the other hand, biomass removal for biochar production can deplete and damage soils.

Different biochar feedstock:

Biochar feedstock is known to be of significant importance to biochar impacts, including short-term impacts on soil fertility. Various research programmes are looking at characteristics of biochar from different feedstock. So far, no study of biochar from sat cedars, juniper or pinyon pine has been published, yet all three are proposed as biochar feedstocks in the WECHAR Bill.

Pollution concerns:

Charcoal dust is a known of pneumococoniosis, a potentially fatal lung disease.[iv] Pollutants in biomass tend to be concentrated in charcoal. This applies to air pollutants absorbed by trees. The European Commission, following a study in Norway, has called for the regulation of wood ash after high levels of heavy metals (cadmium, zinc, lead) were found in wood ash from virgin wood taken well away from roads, high enough for it to qualify as 'toxic waste'.[v] There are also concerns about the possible retention of carcinogenic PAHs in biochar.

There are major concerns about the large-scale removal of biomass as well as about the potential for large-scale land conversion to biochar plantations. Concerns relating to the proposals in the WECHAR Bill are listed below.

For further details see: www.biofuelwatch.org.uk/docs/biocharbriefing.pdf and www.econexus.info/pdf/Agriculture_climate_change_copenhagen_2009.pdf .

How will the WECHAR Bill impact on scientific research?

The WECHAR Bill includes provisions for research grants to identify the economic potential for biochar, as well as the 'environmental benefits' and environmental impacts of biochar. Biochar research programmes will therefore be tied to facilitating deployment even though basic knowledge about the climate and soil fertility impacts of biochar is still lacking. No national programme exists to support other areas of soil science research and the provisions in the WECHAR Bill would bias soil science research in favour of a single unproven technology.

Has any other legislation relating to biochar been proposed?

Senator Stabenow from Michigan has proposed the Clean Energy Partnerships Act (S. 2729), an amendment to the Climate Bill which includes detailed provisions for agricultural offsets, including for biochar.

Salt cedar (tamarisk) removal for biochar?

Salt cedar removal from the Mojave Desert is proposed in the WECHAR Bill on the grounds that this would help to restore the natural hydrology of ecosystems. There is significant evidence that salt cedar removal does not help restore natural hydrology and that mechanical salt cedar removal in particular has serious negative impacts.

Salt cedars have extensive roots, up to ten metre deep, and they regenerate if roots are left behind. The WECHAR Bill would rely on the mechanical removal of salt cedars, including their roots. This would almost certainly involve the use of heavy machinery which disturb and compact soils with serious negative consequences for future plant growth. Vegetation clearance makes river banks more vulnerable to erosion. On the other hand, if herbicides were used before mechanical removal of salt cedars, there is a high risk of toxins being concentrated in biochar and potentially entering the food chain.

Salt cedar removal without active restoration programmes (which are not proposed in the WECHAR Bill) commonly leads ecological degradation. One peer reviewed study in 2006 concluded: "Land managers should be prepared for persistent depauperate plant communities following tamarisk removal if additional

restoration measures are not instigated".[vi] It was found that "native riparian vegetation showed only a modest recovery following tamarisk removal, even when natural flooding regimes were present." The authors suggested that an increase in droughts and lowering of groundwater levels makes it harder for native vegetation to fill the space left behind after salt cedar removal. The moderate increases in native vegetation after salt cedar removal was largely for grasses and herbaceous flowers, not shrubs and trees. Native birds, including the endangered Southwestern Willow Flycatcher, which is found in the Mojave Desert, can thus lose their habitat. In March 2009, the Center for Biological Diversity and the Maricopa Audubon Society filed a lawsuit against USDA's Animal and Plant Health Inspection Service (APHIS) and the US Fish and Wildlife Service against the indiscriminate introduction of tamarisk leaf-eating beetle into critical habitat of the Southwestern Willow Flycatcher. Both organisations call for programmes to actively restore native vegetation.[vii] USFW and APHIS have refused permission for an extension of the tamarisk-removal programme through leaf-eating beetles into Utah partly due to concerns over the Southwestern Willow Flycatcher. Other bird species are also at risk from indiscriminate salt cedar removal. In cases where natural river flow cannot or will not be restored, maintaining salt cedars has been proposed as the best approach to protecting riparian bird species.[viii]

Pinyon pine-juniper in Arizona - trees which could be chopped down to make biochar under the WECHAR Bill ('excessive biomass').

Hydro dams, river diversion and groundwater pumping are known to favour salt cedars. Another study[ix] has shown that in two areas where water diversion for irrigation causes drier condition or impounds spring floods, salt cedars spread, but native tree populations of populus and salix declined.

Claims about high water use by salt cedars are based on old studies and are not born out by results of new research which relies on more accurate measuring techniques. According to a 2009 study[x], the evapo-transpiration rate of and thus water use by salt cedars is similar to that of native trees and "a restored plant community would likely use more, rather than less, water than the current saltcedar stands." Furthermore, there is experience of salt cedar removal not increasing water flow, for example of the Pecos River in Texas.[xi]

Large-scale indiscriminate salt cedar removal in the Mojave Desert, without active ecosystem restoration measures thus cannot be justified as hydrological or ecosystem restoration and could potentially have very negative effects on biodiversity and soils.

Pinyon-juniper and other "excess biomass":

The WECHAR Bill defines 'excess biomass' as "any plant matter targeted for removal from public land to promote ecosystem health", including trees, tree waste, wood, wood waste, weedy plants and grasses. No evidence is required as to why biomass removal would support ecosystem health. This opens the door to large-scale deadwood and other 'forest residue' removal on public lands, which is linked to major reduction in forest carbon, biodiversity losses (since a large percentage of insects and the wildlife which relies on them depend on deadwood), soil nutrient depletion and soil compaction due to the use of heavy machinery. Living trees, in particular pinyon pines and junipers in the Great Basin are also classed as 'excess biomass'. As with salt cedars, the WECHAR Bill proposes the removal of pinyon pines and junipers on public lands for biochar production without any restoration measures.

There is significant controversy over the role of pinyon pines and junipers in ecosystems in the Great Basin. Although pinyon pines and junipers have significantly increased their range during the 20th century, it is not clear in how far this represents recovery after previous logging, and adaptation to climate change. A research project is being carried out at the University of Nevada to compare the current range of pinyon pine and juniper in Nevada with their historic range.[xii]

Furthermore, there are serious concerns about the impact of pinyon-juniper removal on biodiversity. Pinyon-juniper woodlands provide varied and diverse habitat and support at least 70 bird and 48 mammal species.

According to Jeffery Whitney, Biological Resources Group Leader of the US Forest Service, "most wildlife species occur within this habitat type, at least seasonally, or as migratory species, pass through them. The high degree of variability within piñon-juniper in the Southwest provides an array of conditions and management opportunities. At lower successional states (lower densities), piñon-juniper provides high quality habitat."[xiii]

Bark beetle and biochar:

Bark-beetle infested wood from the Intermountain West is another feedstock specified in the WECHAR Bill. There are two main concerns about biochar programmes based on beetle-infested wood: The potential for spreading infestations and reduced forest regeneration following salvage logging. Furthermore, large numbers of biomass power stations are already being built across North America and Europe all intending to burn beetle-infested wood from North America, most likely creating competition for the same wood.

Potential spreading of infestations

The WECHAR Act specifies that pyrolysis units used for charring beetle-infested wood as well as other non-infested wood deemed to increase fire risks should be transportable within 30 days. This suggests that beetle-infested wood would be transported not across different states but nonetheless far enough to make the operation viable without frequent costly re-location of pyrolysis units. Even if the wood was chipped first, transporting it risks spreading beetle infestations. Emerald Ash Borers (EAB) were shown to have been spread in South-east Michigan through the transport of large chips and wood pieces to a 'Biomass Recycling Operation', in violation of Michigan's EAB Quarantine legislation.[xiv]

Wood removal and forest regeneration:

Beetle-infestations are increasingly understood as reflecting on forest health. Wood removal including salvage logging in beetle-infested forests causes further stress including to regenerating forests and thus makes them more vulnerable to future infestations. Wood removal in beetle-infested forests requires the use of heavy machinery and thus causes soil compaction and long-term damage to soils, making regenerating or remaining forests more vulnerable to future infestations. Forest thinning and trunk and root injury during logging have also been shown to predispose forests to beetle attacks.[xv]

A recent scientific review shows that logging in beetle infested forests does reduce fire risks to people and houses, and degrades ecosystems, including through necessary road building in roadless forests.[xvi]

A study in Central Europe compared the regeneration of spruce forests with and without salvage logging following an extensive bark beetle outbreak. The effect of salvage logging on vegetation was found to be worse than that of the beetle outbreak. Salvage logging reduced species diversity and delayed forest regeneration. The study also showed that without logging, regeneration is likely to directly lead to forest recovery, without a pioneer stage.[xvii]

Biochar and bioenergy:

The WECHAR Bill refers to the use of biomass for biochar as well as bioenergy production through pyrolysis However, the more biochar is produced, the less energy is gained from a tonne of biomass. Policies aimed at creating a new market for biochar will favour pyrolysis systems which reduce energy production.

SCIENTISTS' STATEMENTS ABOUT PROPOSAL IN THE WECHAR BILL RELATING TO SALT CEDAR REMOVAL

Note that the statements below are free-standing and entirely separate from the text above

Matthew K Chew, Assistant Research Professor at Arizona State University School of Life Sciences

By the 1930s western surface waters were effectively fully appropriated under the doctrine "first in time, first in right". Ever since, schemes to wring one more appropriable acre foot from western watersheds have focused on killing off vegetation: native and alien, upland and riparian. Federally funded projects demonstrated, again and again, that the amount of water thus salvaged was effectively unmeasurable, and that "vegetation control" required recurring intensive intervention with herbicides (a favorite being the combination later code named "Agent Orange") and bizarre heavy equipment like the aptly named "Le Tourneau Tree Crusher". Saltcedar (tamarisk) entered the western landscape via plantings during federal

erosion control projects. Meanwhile, Reclamation era damming and diversion turned western hydrology topsy-turvy by drying up rivers in the spring and flooding them through summer and autumn. By coincidence this favored the evolved phenology of tamarisk, i.e., the timing of its reproductive cycle, over that of what we might now reasonably call the former natives. Over the past century tamarisk has become the functional centerpiece of western riparian areas, the primary productive basis of a revised and still evolving ecosystem. Rationalizing the proposed commodification and disposal of tamarisk with claims that it is geographically or ecologically unbelonging flies in the face of logic and objective science. Tamarisk is not merely a weed. In terms of total physiological activity, Tamarisk represents the bulk of southwestern riparian ecology, and inevitably structures the remainder. In terms of demonstrable "water salvage" calling for tamarisk removal is tantamount to promoting sodbusting because "rain follows the plow." It will just as surely follow the bulldozer. Southwestern hydrology cannot be restored by fiddling with mere survivors of wholesale damming, diversion, groundwater extraction, and a legal doctrine that rewards overusers with the privilege of overusing.

Dr. Edward P. Glenn, Dept. of Soil, Water and Environmental Science, Environmental Research Laboratory of the University of Arizona

Numerous recent studies have shown that saltcedar uses about the same or less water than native trees species on western rivers. Furthermore, studies have shown that it does not displace native trees; rather, it replaces them on flood plains that have become too saline or dry to support the natives. This results when rivers are dammed and diverted, preventing overbank flooding that is required to wash salts from river banks and germinate new trees. Saltcedar is able to grow under these conditions. Studies also show that saltcedar supports a wide range of bird species, especially in mixed stands with native trees and in proximity to water. Finally, the biocontrol beetle might further damage western riparian landscapes, especially on rivers where native trees will no longer grow. I have attached three articles: the first two are reviews questioning the assumptions about high water use and possible damage by beetle release; and the third a case-study of saltcedar on the Lower Colorado River, showing that water use is moderate and (in this case) lower than native vegetation.

I personally would not favor the WECHAR bill on a number of grounds.

Dr Juliet Stromberg, School of Life Sciences, Arizona State University

The "WECHAR" bill seems premature. One goal of the bill is "to restore the natural hydrology of Western landscapes by removing water-intensive invasive plant species" (saltcedar)". If one truly wished to restore the natural hydrology of Western landscapes, one would remove the major structures that are modifying the stream flow- the large flow regulating dams and the diversion structures. Focusing on plant removal has been shown to be an unproven technique. There is a long history of pheatophyte control for "water salvage" in the US West, with efforts to remove cottonwood and other riparian trees having taken place following the drought of the 1950s. These efforts were abandoned for lack of success. Now, efforts again are targeting riparian trees, with emphasis on the introduced saltcedar. By nature, riparian trees in dryland regions are 'water-intensive', and the introduced saltcedar is similar in its water use rates to other riparian trees. Saltcedar-clearing for water salvage will not yield the expected benefits. What it will do is alter habitat, and in many areas the clearing will eliminate the only woody vegetation available to supports riparian birds, including the endangered southwestern willow flycatcher.

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[iii] Biochar, Climate Change and Soil: A Review to Guide Further Research, Saran Sohi et al, CSIRO, 2009, www.csiro.au/files/files/poei.pdf

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[xiii] Wildlife Management in Southwestern Pinyon-Juniper Woodlands, Jeffrey C Whitney, USDA Forest Service Proceedings RMRS-P-51. 2008.
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[xv] www.dnr.wa.gov/Publications/rp_fh_wadnrbarkbeetle.pdf
[xvi] Insects and Roadless Forests, A Scientific Review of Causes, Consequences and Management
[xvii] The influence of bark beetles outbreak vs. salvage logging on ground layer vegetation in Central European mountain spruce forests, Magda Jonasova et al, Biological Conservation, June 2008