Permaculture Institute of North America Response and Comment: Docket ID: NRCS–2022–0015

The Permaculture Institute of North America (PINA) appreciates the opportunity to comment on Docket ID: NRCS–2022–0015: Request for Public Input About Implementation of the Inflation Reduction Act Funding solicited by USDA Natural Resource Conservation Service.

PINA is a non-profit trade association supporting professional and community practice of permaculture across North America through continuing education, mentorship, diploma recognition, and employment. We identify, fund, and staff critically important projects in land, community, and climate regeneration. Our goals include highlighting the holistic design system of Permaculture and its principles to impact public policy and private development, and thereby improve the quality of life for all. We bring permaculture ethics and solutions to bear on the challenges of social justice, land regeneration, and climate cooling.

Permaculture is a global social movement centered around grassroots training in the design of holistic ecological systems. It aims to improve the lives of all people while conserving and regenerating ecosystems everywhere. The design system makes use of local values, ecosystem models, and patterns in nature. It draws upon traditional ecological knowledge, new empirical practice, and data-driven science.

PINA has deep experience in natural carbon sequestration and climate change adaptation and mitigation through permaculture design, tools, and techniques. Organizational management and PINA members have professionally implemented many systems of the types detailed below, and PINA as an organization has done field trials in biochar production from excess fuels in Western forests as an improved fire mitigation protocol that effectively sequesters carbon otherwise at risk while improving water retention and forest health. We have documented results, published a film about that work, and established guideline for improved practice. For input to this RFI, we also queried our membership; those results are incorporated herein. Thus, we offer the following considerations in response to your agency's questions.

1) *What systems of quantification of greenhouse gases emissions and carbon sequestration through NRCS programs for conservation, ecological integrity, agricultural systems, agroforestry and forest management for resilience.*

In general, we encourage incorporation and funding of the following practices specific to your EQIP, CSP, and additional special programs focused on building soil carbon, agroforestry, and tree-planting as a framework for encouraging and supporting biodiversity, ecosystem services, and functioning ecosystems that provide food, fodder and fiber as distinct from single purpose or no-purpose plantations and monocultures. Managing biomass waste from animals, food crops and products, and agricultural and forest systems is likewise essential. Composting and practices such as NRCS 336 and 808 (biochar) are excellent foci for funding.

1a.) What systems of quantification should NRCS use to measure the carbon sequestration and carbon dioxide, methane, and nitrous oxide emissions outcomes associated with activities funded through IRA?

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We call your attention to the work of Project Drawdown (https://www.drawdown.org) touted as the most comprehensive plan to reverse global warming through practices that bring about the natural drawdown of carbon and reduce GHG emissions. Project Drawdown explains their methodology, caveats, and specific quantification of CO_{2e} sequestered and, at what cost, by activity under two climate scenarios. Permaculture's global experience and published literature strongly informed much of their work.

As stated on the Project Drawdown website, "All solutions are based on an extensive analysis of the scientific literature and sophisticated modeling, and share six key traits that set them apart from other climate mitigation strategies. They 1) are currently available, 2) are growing in scale, 3) are financially viable, 4) are able to reduce greenhouse gas concentrations in Earth's atmosphere, 5) have a net positive impact, and 6) are quantifiable under different scenarios."

Specific permaculture practices identified and quantified by international teams of scientists, and described on their website include:

- Conservation Agriculture: farmland protection, restoration, and prevention of land use conversion through policy and incentives for cover crops, crop rotation, and minimal tillage to produce annual crops. https://www.drawdown.org/solutions/conservation-agriculture
- Forest Protection: prevention of deforestation and land use conversion. Retention of old and mature trees. https://www.drawdown.org/solutions/forest-protection
- Temperate Forest Restoration: restoring functionality, connectivity and ecosystem services to temperate forests through biomimetic vegetation and residual biomass treatments such as those supported and incentivized through NRCS's EQIP. https://www.drawdown.org/solutions/temperate-forest-restoration
- Multi-strata Agroforestry: mimic the structure of natural forests by increasing vertical and horizontal integration of trees and crops to achieve high rates of both carbon sequestration and food production. https://www.drawdown.org/solutions/multistrata-agroforestry
- Tree Intercropping: growing trees and annual crops together increases biomass, soil organic matter, and carbon sequestration. https://www.drawdown.org/solutions/tree-intercropping
- Grassland Protection: shield soil carbon and avoid emissions from conversion to agriculture or development. https://www.drawdown.org/solutions/grassland-protection
- Managed Grazing: careful planning and rotation by controlling livestock density and the timing and intensity of grazing. https://www.drawdown.org/solutions/managed-grazing
- Silvopastures: integrating trees, pasture, and forage into a single system for multiple benefits. https://www.drawdown.org/solutions/silvopasture .
- Sustainable Intensification for Small Farms and Ranches: support for sustainable practices such as integrated pest management (IPM), crop diversification, and capacity building can increase productivity while maintaining a small footprint. https://www.drawdown.org/solutions/sustainable-intensification-for-smallholders

- Regenerative Annual Cropping: building on conservation agriculture with additional practices, such as applying compost, using green manures, and organic production. https://www.drawdown.org/solutions/regenerative-annual-cropping
- Perennial Cropping: Compared to annual crops, perennials have similar yields but higher rates of carbon sequestration with lower maintenance, deeper root systems, and higher resilience to weather perturbations. https://www.drawdown.org/solutions/perennial-staple-crops
- Farm Irrigation Efficiency: improved irrigation efficiency and methodologies including capturing, storing, and spreading of water through landscape-specific design. https://www.drawdown.org/solutions/farm-irrigation-efficiency
- Composting: converting organic waste to a valuable soil amendment to build soil carbon. https://www.drawdown.org/solutions/composting
- Biochar Production: sustainable production and use of biochar has myriad benefits including sequestering carbon, improving soil productivity and moisture and nutrient retention. https://www.drawdown.org/solutions/biochar-production

We likewise call your attention to **The Carbon Farming Solution: a Global Toolkit of Perennial Crops and Regenerative Agriculture Practices for Climate Change Mitigation and Food Security** by Eric Toensmeier, a certified permaculture practitioner. This book details many of the solutions itemized above in a real-world context. Toensmeier has been a key partner in Project Drawdown.

Calculating an increase in soil organic matter as an increase in soil carbon is an approach that can be assessed by specific practices is one approach to monitor outcomes and provide metrics for success.

Using biochar as an example: PINA recently developed and piloted a Fire Ecology Restoration Program (FERP) to increase forest resilience in high wildfire risk areas by applying forest thinning and brush reduction in conjunction with waste biomass conversion to biochar in Ring-of-Fire portable modular kilns. The biochar is then applied to forest soils in situ. We needed a field-based carbon estimating methodology, as most of the work in this area has so far been done in laboratories. Together with his colleagues, Dr. Ken Carloni, advisor to FERP. designed a simple method for calculating dry-mass and bulk density of place-based biochar production.

This methodology deals directly with issues of water content and density, is simple, yet effective. Just before quenching a flame-cap kiln of known dimensions, fill to level a metal bucket (of known volume and weight) with hot coals. Weigh three bucketfuls, subtracting bucket weight. Divide biochar weight by volume to arrive at a dry bulk density. We use Ring of Fire kilns, which are a simple cylinder of a specific diameter. So if we level the biochar in the kiln, measure its height, then we can calculate the volume of char produced. Apply the dry bulk density figure to determine the dry mass. Apply the estimate of percent recalcitrant or fixed carbon (see research for range of carbon content based on feedstock) and thus determine the carbon sequestration value of biochar to be returned to the soil.

Placing biochar in soil, as described above, allows carbon accounting after the practice is implemented. Estimating soil carbon contributions before the practice(s) are initiated is more challenging but PINA has explored these and developed a methodology to calculate a range of expected carbon sequestration and GHG emission reductions based on forest resilience treatments with the conversion of waste biomass to biochar.

Baseline parameters needed are: bioregion, habitat type(s), treatment acreage, treatment types. From these additional parameters can be determined from research, landscape analyses, and mapping. For example, general forest type (i.e., mixed stands with moderate to low severity fire or even age stands with high severity; fuel loading by habitat type; and stand structural diversity are commonly mapped parameters. Treatments can be defined by structure class, such as basal area retained, or percent canopy removed, in commercial/merchantable classes, or tons of understory biomass per acre to be removed. These calculations provide a reasonable estimate of the amount of biomass that will be produced. Assume that 80% will be available for charring, that is, biomass excess to the needs of nature, leaving optimal fuel loads by habitat type for nutrient cycling, soil health, small mammal/reptile/insect habitat, erosion protection, etc.

Based on the figures from the Climate Trust Fact Sheet**: Carbon Market Investment Criteria for Biochar Projects**, we use a sequestration rate of 2.53 CO2e/tonne of biochar produced. These data are confirmed by Washington State University.

Emissions: Our results indicate that soil carbon sequestration and biochar have useful negative emission potential (each 0.7 GtCeq. yr−1) and potentially have a lower impact on land, water use, nutrients, albedo, energy requirements and cost, so have fewer disadvantages than many negative emissions technologies (NET).

The following citations may be of some use to your deliberations. Each citation is followed by key concepts and figures found therein.

Springsteen, Bruce et al. “Emission Reductions from Woody Biomass Waste for Energy as an Alternative to Open Burning.” *Journal of the Air & Waste Management Association* 61 (2011): 63 - 68. *Compared with the traditional open pile burning method of disposal for the forest harvest slash, utilization of the slash for fuel reduced particulate matter (PM) emissions by 98% (6 kg PM/BDT biomass), nitrogen oxides (NOx) by 54% (1.6 kg NOx/BDT), non-methane volatile organics (NMOCs) by 99% (4.7 kg NMOCs/BDT), carbon monoxide (CO) by 97% (58 kg CO/BDT), and carbon dioxide equivalents (CO2e) by 17% (0.38 t CO2e/BDT)*

Jones, Greg et al. “Forest treatment residues for thermal energy compared with disposal by onsite burning: Emissions and energy return.” Biomass & Bioenergy 34 (2010): 737-746. *When compared to the pile-burn/fossil fuel alternatives, carbon dioxide emissions from the bioenergy alternative were approximately 60%, methane emissions were approximately 3%, and particulate emissions less than 10 mm were 11% and 41%, respectively, for emission control and no-control boilers.*

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(2) How can NRCS engage the private sector and private philanthropy to leverage the IRA investments, including for systems of quantification?

Some IRA funds should be directed towards helping insurance companies understand that forest resilience practices do indeed reduce the risk of wildfire. We have members and clients who have applied these practices through NRCS or state departments of natural resources grants and yet still have lost their home/property insurance because of their property's location on a risk map. Developing a certification program that would enable landowners to keep their insurance based on site-specific practices implemented rather than be excluded from coverage because of broad and generic wildfire risk mapping. Keeping insurance coverage provides an added incentive to more landowners and communities to implement wildfire resilience practices.

Invisible but real barriers exist in the form of local regulations that attempt to control certain land uses. Helping landowners navigate these local regulations and get exemptions where merited would be a tremendous help.

NRCS might want to collaborate with **Climate Forward**, a program of the Climate Action Reserve by providing connections with landowners who are generating GHG emission reductions. "Climate Forward is designed to provide companies, organizations, developers, and other entities with a conservative, robust, and methodologically rigorous option to mitigate an estimate of expected GHG emissions."

The recent report **Biomass to Biochar: Maximizing the Carbon Value** https://www.fs.usda.gov/rmrs/publications/biomass-biochar-maximizing-carbon-value contains excellent information on engaging with local communities and helping rural economies.

(3) How should NRCS target IRA funding to maximize improvements to soil carbon, reductions in nitrogen losses, and the reduction, capture, avoidance, or sequestration of carbon dioxide, methane, or nitrous oxide emissions, associated with agricultural production?

Again, we point to biochar as an option to reduce nitrogen leaching and nitrous oxide off-gassing. We refer you to:

Influence of Biochars on Nitrous Oxide Emission and Nitrogen Leaching from Two Contrasting Soils J. Environ. Qual. 39:1224–1235 (2010) doi:10.2134/jeq2009.0138. Published online 13 Nov. 2009. By Bhupinder Pal Singh* Industry and Investment NSW. Blake J. Hatton, and Balwant Singh, The University of Sydney, Annette L. Cowie and Amrit Kathuria Industry and Investment NSW. *Due to these inherent chemical and physical properties, biochars can potentially influence a number of soil properties including soil pH, porosity, bulk density, and water holding capacity (Glaser et al., 2002; Chan et al., 2007). The most important finding is that after 4 months, all*

biochars decreased both forms of soil N losses: the N2O emissions were decreased by up to 73% over the whole third Wet–Dry cycle and the leaching of NH4+-N (soil nitrogen) was decreased by up to 94%, relative to the control.

(5) How can NRCS expand capacity among partners to assist in providing outreach and technical assistance to support the implementation of IRA funding?

The practices listed above are only as good as the implementation practices of the land stewards on the ground. Providing education is key. The efforts of trained and experienced USDA employees should be amplified by partners, who, as practitioners, are trained and qualified to deliver tailored region- and locale-specific information.

PINA envisions a broader land use and agroforestry certification process like that of the existing forestry-focused Technical Service Provider (TSP) program of NRCS, but commensurate with the scale of the climate crises. The aim would be to create a network of certified practitioners who can assist landowners directly. To implement and expand a broader TSP program, NRCS should take advantage of professional organizations, like PINA, that already conduct rigorous training and certification, and which have identified thousands of qualified candidates. A TSP corps specializing in soil carbon sequestration and other natural, accessible, and affordable climate mitigation strategies could create an invaluable resource for landowners, and be a real force-multiplier for NRCS.

We encourage the use of holistic design systems that look beyond a climate or carbon response to provide ecological context that incorporates environmental, economic, and social factors for each situation. Integrated ecological solutions provide positive feedback loops, which enhance any space with increased yields and reduced maintenance as they mature.

Maintenance and monitoring are two other considerations that must be taken into account in proposals and fully funded. These elements likewise depend on human capital and motivation. This again underscores that the human dimension is as important as the physical and biological constraints. It must be incorporated if we are to maximize our chances for success.

(4) How should NRCS streamline and improve program delivery to increase efficiencies and expand access to IRA funded programs and projects for producers, particularly underserved producers?

We offer these considerations.

Underserved producers occur across many regions in many demographics, but a large number of such producers are concentrated in and around urban areas and on tribal lands. They sometimes have large communal holdings, but are most often small-holders. Yet they have community connections and resources that are rarely valued adequately. To offer TSP support and design training for producers and community leaders in these settings would leverage

social capital that is almost certainly not in the agency's sights as a factor in democratizing, supporting, and transforming food production and land use systems. An example is the community food hub model, often led by churches and other NGOs, sometimes coupled with community gardens, incubators for small farm development, consumer re-education, health, and mutual aid projects. These micro-efforts, largely unseen and unacknowledged, quite like the bottom-up push of women who created Victory Gardens during WWII, hold enormous potential for contributing to our collective struggle against the climate threat. This is an arena where the best approaches will both provide tools for underserved producers and reshape community behaviors to mitigate and adapt to climate change, engaging a mass of citizens in what must ultimately be a national mobilization.

PINA particularly supports using the Train-the-Trainers model whereby trusted and respected community members are trained, mentored, and in turn become long-term, in-residence trainers in their communities. PINA has developed, through a National Science Foundation proposal, this very model adapted for under-served communities in urban settings. We would be happy to share that model with you upon request.

To facilitate effective outreach to all groups and sectors, aesthetic considerations should be intimately woven into all activities and practices. Even though aesthetics have been largely ignored under the historic American stress on utilitarianism, these matters are far from frivolous. Beauty plays an important role as an attractor to a wide range of people, and serves as a valuable, even intrinsic metric of success. If a practice is not pleasing to the eye, despite whatever functionality it offers, it is less likely to be adopted, or to serve as an inspirational model.

Beauty and aesthetics transcend race, ethnicity, gender and identity, as does personal satisfaction in accomplishment. The ability to see something for oneself is critical to both of these powerful motivators, and this comes about in two primary ways: firstly, seeing something attractive, successful, and near at hand, and secondly learning to adopt and emulate it in one's own life. This formula for change is underscored by studies from the Max Planck Institute: "When people converse in their day-to-day lives, they often speak about what they hear, smell, taste, or feel. First and foremost, however, they talk about their visual perceptions. This is the conclusion of a team of scientists headed by Lila San Roque, Kobin H. Kendrick, Elisabeth Norcliffe and Asifa Majid at the Max Planck Institute for Psycholinguistics in Nijmegen in the Netherlands…" https://www.mpg.de/8849014/hierarchy-senses Story-telling (vicarious experience) precedes and opens the doorway to visceral experience (shared work). These two poles create a virtuous cycle of action, as one feeds the other.

USDA Forest Service (USFS) and USDI Bureau of Land Management (BLM) use a visual quality management system that could be adapted for use for NRCS practices. One of the authors of this comment letter, a landscape architect and former USFS employee, has decades of experience and numerous awards for her work in visual resource management.

Therefore, well-designed, attractive, and of course, functional solutions that are modeled and accessible to the target audience of potential practitioners should be given high priority. Building on existing private efforts, demonstration farms, ranches, forests and permaculture installations should be funded and supported across the country in all regions to establish conditions for effective social contagion of effective practices.

A social, even an epidemiological design (dare we compare it a vaccination campaign, inoculating the country against the deadly threat of atmospheric heating), in service to technical innovation could dramatically accelerate a profound shift in land use, at the scale required to impact climate change. This demands a new vision. IRA funding provides the fuel for such a vision to manifest.