Preserve Craig ~ *Sustaining the Quality of Life We Value*

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Ms. Kimberly Bose, Secretary

Federal Energy Regulatory Commission

888 First Street NE, Room 1A

Washington, D.C. 20426

Dockett PF-15-3-000

Re: Economic and Environmental Impacts of Invasive Plant Species

We respectfully call the attention of the FERC to the critical issues of environmental degradation and economic impacts that are caused by the spread of nonnative invasive plant species. Pipelines in particular can exacerbate this problem, but little has been done in the past to effectively prevent this problem or mitigate it when it has occurred. Pipeline construction and maintenance can impact thousands of acres through the spread of invasive plants, and landowners should not be expected to shoulder the burden of managing this serious problem that would be created by the MVP. We ask that the FERC require detailed study of this issue, and the creation of an independent third-party, scientifically based, long-term management plan to address it.

Sincerely,

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for the Science and Technology Committee,
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Economic and Environmental Impacts of Invasive Plant Species

<u>ISSUE:</u> The MVP corridor would be a conduit to introduce and spread harmful nonnative invasive plant species in Craig County, and along the entire length of the pipeline. This will destroy ecological integrity of private and public lands, threaten public health, and create land-management problems for the life of the pipeline and beyond.

SUMMARY

What to Expect if the Pipeline is Built:

- **The MVP will degrade one of the premier sites for biodiversity and endemism in the eastern United States.** The spread of nonnative invasive plant species in this region will negatively impact a range of endemic and other uncommon plant and animal species, degrade unique and uncommon natural habitats, and reduce ecosystem resilience to other challenges such as climate change.
- **Construction and maintenance of the MVP pipeline corridor will create more than 52 miles of new, easily invaded, edge habitat in Craig County**; through or adjacent to previously undisturbed or minimally disturbed National Forest; Wilderness Areas; previously unbroken interior forest; steep, erodible forested mountain slopes; erodible remote mountain ridge tops; unique boulder field habitats; ephemeral and perennial streams and wetlands; conservation easements; critical watershed protection areas; private and public wildlife habitat restoration areas; pollinator conservation areas; threatened and endangered species habitats; private farms and grazing lands; sustainable forestry operations; organic farming operations; residential housing developments; and historical farms and battlefields.
- **Construction and maintenance of the pipeline corridor will exacerbate invasive-plant management problems in perpetuity**. Such problems will be accelerated if pipeline construction does not effectively preserve and replace topsoil after excavation.
- **Pipeline construction** without detailed and appropriate planning to prevent the spread of invasive plants **will violate the spirit if not the letter of the law** related to numerous state, federal, and private efforts to prevent significant economic and ecological damage by invasive species.
- **Nonnative invasive plants species will be spread extensively** throughout the pipeline corridor and adjacent non-corridor lands by wind, water, animals, and human activities.
- **Deer populations will increase, as will vehicle-deer collisions and deer-related damage** to agricultural and home landscapes.
- **Populations of deer-hosted ticks will increase, as will incidence of serious human diseases** transmitted by these ticks.

- **Increased deer activities will intensify the spread of invasive plants in all habitats.** The pipeline corridor will directly link habitats currently infested with nonnative invasive plant species to public lands (Jefferson National Forest) and private properties that are not currently infested. **Particularly troublesome invasive plant species will include autumn olive, multiflora rose, tall fescue, and tree-of-heaven.**
- If the pipeline is co-located in the narrow power line corridor between the two National Forest Wilderness Areas in southern Craig County, the penetration of those Wilderness Areas by nonnative invasive plant species will be greatly accelerated and **the ecological integrity of the Wilderness Areas will be compromised.**
- **Populations of interior forest species (both plant and animal) will decline** on both public and private lands. Negative impacts of the pipeline corridor will reach much farther into interior forest areas than just the 125-foor construction corridor, effectively **magnifying corridor effects to more than 700 feet (85 acres for each mile of corridor).**
- **Expensive control programs will be required** to control nonnative invasive plant species, not only on the pipeline corridor but also on other public and private lands in the county.
- Planned corridor-**maintenance programs on the MVP will actually favor and spread nonnative invasive plant species.**
- **Extensive use of chemical herbicides will likely be the only effective control** for nonnative invasive plant species in the pipeline corridor, and such control will be necessary for the lifetime of the pipeline and beyond. **Such herbicide use will be in direct contradiction to MVP's previous pledge** to forgo the use of herbicides in corridor management activities.
- **Herbicide use in the pipeline corridor will cause collateral damage to public and private lands and livelihoods in the county, including sustainable forestry,**
- **grazing lands, grass-fed beef operations, orchards, home gardens, honeybee apiaries, certified organic farming operations, groundwater supplies, tourism, and possibly human health.**
- **Critical ecosystem services** (air and water purification, water supply and quality; wildland recreation) in the county and residents' attachment to place **will be damaged and reduced. Climate change will increase the negative effects of invasive plant species** in the local environment.
- **Agricultural lands will be devalued** by the increased presence of nonnative invasive plant species.
- **Agricultural and forestry-related production and incomes in the county will be reduced**, and livelihoods damaged.

What Must Be Thoroughly Analyzed and Evaluated in the EIS for the Pipeline:

- The proximity of nonnative invasive plant species to the proposed corridor route, and the threat of these species being spread by pipeline-corridor construction and maintenance.
- The mechanisms and chronology of likely spread of nonnative invasive plant species as a result of pipeline-related activities.
- Congruency of pipeline interactions with nonnative invasive plant species to existing county, state, and federal laws; and county, state, federal, NGO, and private-landowner efforts to control and even reverse the spread of invasive plants.
- Alternative approaches for the early detection, rapid response, and effective control of nonnative invasive plant species in the pipeline corridor, and the ecological and economic risks associated with each approach.
- Risk assessment of economic and ecological damage that would be caused by the accelerated spread of nonnative invasive plant species due to pipeline construction and maintenance.
- Valuation of the loss or damage to critical ecosystem services caused by pipeline construction and maintenance, and critical assessment of possible approaches to mitigating those losses.
- Risk assessment of human-health threats due to pipeline-linked increases in deer populations, increases deer-hosted tick populations, and herbicide use in the pipeline corridor.
- Specific critical analysis of the known and likely ecological, economic, and human-health impacts of extensive herbicide use for pipeline corridor maintenance.
- Hidden costs to private landowners and the public (i.e., externalities: costs borne by individuals who made no choice to bear such cost) in terms of opportunity costs, loss of ecosystem services, loss of land productivity, loss of property values, loss of esthetic values related to their land and public lands in the County, threats to human health and well-being, loss of personal freedom and well-being), and assessment of possible mitigation approaches to compensate for these losses.
- MVP's corporate responsibility for effective mitigation of all negative effects of pipeline construction and maintenance for the life of the pipeline; clear identification and explanation of the succession of responsible parties at all stages of construction, operation and maintenance of the pipeline; and specific identification of parties who will bear responsibility for environmental and economic impacts that will extend well beyond the life of their pipeline project.

Critical Regulatory Requirements to Protect Citizens of Craig County if the Pipeline is Approved for Construction:

- The alternative route that threads through the existing power line corridor between the Brush Mountain and the Brush Mountain East Wilderness Areas **should be completely disallowed**, to prevent unavoidable and prohibited degradation of the Wilderness Areas by invasive plant species.
- **Before any construction commences,** MVP must be required to **survey the pipeline corridor and the adjacent lands** (for a distance of at least 1 mile) to ascertain the presence of invasive plant species that are likely to become or increase as land-management problems. This survey should be accomplished by independent, third-party scientists with qualifications and certifications for this work.
- MVP must be required to **create an Invasive Species Management Plan (ISMP)** that covers management of invasive plant species for the entire expected lifespan of the pipeline. Again this plan should be developed by qualified, independent, third-party scientists. The plan should be **detailed in scope and scientifically supported with appropriate references** to the refereed scientific literature. The plan should include **EDRR (Early Detection and Rapid Response) strategies** for acceptably reducing the risk of the spread of invasive plants, and detail rapid-response actions to be employed when invasive plants species are detected to be spreading. The plan should include segments that detail contractor education programs related to identification of invasive species and critical actions to prevent their spread; detail appropriate guidelines for the cleaning of equipment coming into the pipeline corridor;
- The ISMP and EDDR should investigate and evaluate **non-herbicidal control options,** and develop strategies for their use in a control program that can be demonstrated to have a high likelihood of success.
- The plan must include **appropriate mitigation to be employed** when invasive plant species create public or private land-management problems as a result of the pipeline presence. If such problems occur, MVP should be required to offer assistance to private landowners, county government, or other entities impacted by these problems.
- To prevent collateral damage to public and private lands, agricultural operations, and public health, MVP (and management successors) must be **forbidden to use herbicides in the pipeline corridor.**
- MVP must be required to preserve and replace topsoil during construction, as failure to do so will only exacerbate the loss of native species and the invasion of nonnative invasive plants species.
- Due to the tremendous financial and environmental risks posed by the introduction and spread of nonnative invasive plants species by the MVP project, an independent, third-party with appropriate scientific qualifications and credentials should be retained (by MVP or successors) to design and operate these survey, monitoring, and control programs for the entire life of the pipeline, from pre-construction phases through ultimate removal of the pipeline and true reclamation and restoration of the damaged habitat.

- MVP must be required to **post an appropriate financial bond** with the County, sufficient to cover liability for the life of the pipeline to cover County expenses for invasive plant control on county road rights-of-way and other county lands, and for the county to assist affected landowners with invasive plant control on private lands that have been impacted by invasive plants spread by the MVP project. This bond should also be sufficient to mitigate all damages likely to be caused by herbicide use, if MVP breaks their pledge to not use chemical herbicides in the pipeline corridor.

Extensive information to support these statements, and associated references, are offered in Appendix A (following).

Appendix A: SUPPORTING BACKGROUND and REFERENCES

Definition and Problem Scope

Nonnative invasive species (NNIS) are species intentionally or accidentally introduced by human activity into a region in which they did not evolve and cause harm to natural resources, economic activity, or humans (USFS 2012; VDCR 2015).

Invasive species can adapt to a wide range of environmental conditions. Such traits are part of the very reason that they become invasive, as they can outcompete native species with more limited environmental tolerances (Daehler 2003; Myers and Bazely 2003; Pysek 2012). NNIS can shape the environment to their own benefit, which can make them even more successful in competition with other species (Jones et al. 1994; Mack and D'Antonio 1998; Cuddington and Hastings 2004; Baiser et al. 2008). The theoretical argument as to whether nonnative invasive plant species cause or are simply favored by ecosystem changes in habitats degraded by disturbance (MacDougall 2005) is irrelevant here, as is discussion of the exact mechanism of their competitive success (Levine et al 2003). The simple fact is that invasive plants often flourish in disturbed habitats (Hobbs and Huenneke 1992; Swearingen et al. 2010; USFS 2012; Jones et al. 2015) and a pipeline corridor such at that proposed by MVP is a major disturbance that will in all likelihood lead to a significant increase in land-management problems related to nonnative invasive plant species.

NNIS can create severe environmental problems, causing more than $137 billion in economic losses annually in the USA (Pimental et al. 2000), and a significant portion of these losses is due to nonnative invasive plant species (Duncan and Clark 2005). Losses due to invasive species in Virginia may be as high as $1 billion annually (Pimental et al. 2005). NNIS damage and degrade crops, pasture and forestlands, clog waterways, spread human and livestock diseases, and destroy trees. NNIS are now widespread across an increasing number of acres in the United States, posing threats to habitats and economies in areas as diverse as agriculture, forestry, livestock, fisheries, and recreation (Chornesky et al. 2005; USFS 2012). NNIS have spread to a wide range of ecosystems and now rank just behind habitat loss as the leading cause of rare species declines (Wilcove et al. 1998). The impact of invasive nonindigenous species on natural areas is likely to be permanent, in part because economic and environmental factors limit eradication or control options that may be appropriate in agricultural settings (National Research Council 2002). Furthermore, impacts of invasive species are exacerbated by climate change (Dale et al. 2001; Pimental et al. 2005; Tausch 2008) so their effects may become more severe in the future. Invasive species can reduce ecosystem services and affect human well-being (Pejchar and Mooney 2009). Local, state, tribal, and national governments; public agencies; non-profit organizations; private corporations; and individual landowners have recognized the NNIS threat and are taking broad and expensive steps to address these problems (USFS 2012); the FERC's environmental impact assessment for interstate gas pipeline projects needs to fully analyze the potential for these projects to create and exacerbate environmental and economic problems related to nonnative invasive plants species. The nature of construction and management activities associated with these pipelines creates a higher risk of extreme impacts due to invasive plants than many other energy projects. These unique and severe risks for pipelines have never been fully analyzed, evaluated, and mitigated. Credible scientific analysis of these problems and

risks is sorely needed before FERC decisions are made regarding the multitude of proposed pipeline projects that will bisect and fragment large areas of the eastern USA. Such analysis is required by the National Environmental Policy Act (NEPA), and is a serious obligation meant to protect critical ecosystem services on which human well-being and economic opportunity relies, for both present and future U.S. citizens.

Spread and Impacts of Invasive Plant Species

Nonnative introduced plant species proliferate and displace native plant species, reduce wildlife habitat and alter natural ecological processes (VDCR 2015). Some clues to the ability of nonindigenous plants to become invasive are suggested by the traits by which some compete with native species or alter their new range to their advantage. Those traits include light-sequestering abilities (as in climbing vines), deep or dense root systems that capture water, abundant fruit or nectar that attracts pollinators and seed-dispersers, nitrogen-fixing capacity that alters soil composition, and fire-facilitating and fire-resisting attributes that alter fire cycles. Expression of any of these traits can greatly diminish the role of native species in an ecosystem, and associated ecosystem functions and services (National Research Council 2002). Plants become invasive when their traits interact synergistically with resource availability, disturbance, and the structure of native plant communities (Myers and Bazely 2003). Traits that contribute to invasiveness include, but are not limited to, natural robustness, higher resource-use efficiency than native plants, ability to form pure stands and competitively exclude other species, high reproductive output and/or propensity for vegetative reproduction, animal-dispersed seeds, and the ability to form a seed bank (Webster et al. 2006).

Forest fragmentation (as is caused by linear pipeline corridors) has been associated with the spread of invasive plant species. Many invasive species are associated with disturbance. Many thrive on bare soil and disturbed ground where native plants have been displaced. Some invasive species may initially enter forests on vehicles or equipment. Japanese stiltgrass (*Microstegium vimineum)*, garlic mustard (*Alliaria petiolata)*, shrub honeysuckles (*Lonicera* spp.*)*, and common privet (*Ligustrum vulgare)* are all examples of invasive plants found within eastern forests. Once established, these invasive species can outcompete or make conditions unsuitable for native forest species (from Brittingham 2015).

Detrimental effects of invasive plants in natural ecosystems may include a reduction in native biodiversity, changes in composition of ecological communities, alteration of ecological processes that provide critical ecosystem services, loss of habitat for dependent and native species (including wildlife), changes in biogeochemical cycling, and alteration of ecosystem response to disturbances (e.g., severe weather, flooding, fire, etc.) and the capability of the ecosystem to protect human well-being from such disturbances (Hobbs and Huenneke 1992; Tausch 2008).

Impact of Invasive Plants on Critical Ecosystem Services

Ecosystem services are the aspects of ecosystems utilized (actively or passively) to produce human well-being. The key points include that services must be ecological phenomena and that they do not have to be directly utilized. Defined this way, ecosystem services include ecosystem organization or structure as well as process and/or functions if they are consumed or utilized by humanity either directly or indirectly (Charles and Dukes 2007).

Ecosystem services include both goods, which have direct market values, and services that in turn maintain the production of goods and biodiversity, and directly or indirectly benefit humans (Daily et al. 1997). Several classification schemes exist to categorize ecosystem services, but they are perhaps most easily thought of in terms of four major categories (from Charles and Dukes 2007):

1. ***Provisioning services*** are products obtained from ecosystems, and include food (crops, livestock, fisheries, etc.), fresh water, fiber (timber, cotton, silk, etc.), biochemicals/pharmaceuticals/natural medicines, fuel, genetic resources, and ornamental resources.

2. ***Regulating services*** are obtained from the regulation of ecosystem processes, and include carbon sequestration, air quality regulation, climate regulation, water regulation (timing and extent of flooding, runoff, etc.), water storage, water purification, waste treatment, disease regulation, natural pest control, pollination, erosion control, fire regulation, and storm protection.

3. ***Cultural services*** are non-material benefits, and include aesthetic values, recreation/tourism, spiritual/religious values, educational/scientific values, cultural heritage values, inspiration, and sense of place.

4. ***Supporting services*** are overarching, indirect, and occur on large temporal scales, but are necessary for the maintenance of other services. They include photosynthesis, primary production, nutrient cycling, water cycling, soil formation and maintenance of fertility, as well as atmospheric composition.

Ecosystem services thus have high value to humanity, and should be protected as valuable resources. If such services are lost or destroyed, they must be replaced or the quality of human life declines. Technology can sometimes replace lost services, but generally only at very high cost. Sometimes services cannot be replaced at all, and quality of life suffers. Thus ecosystem services should receive appropriate valuation analysis, high-level protection, and full mitigation if they are damaged.

Invasive species can cause significant impacts to ecosystem services on which humans rely (Millennium Ecosystem Assessment. 2005; Charles and Dukes 2007). For example, nonnative invasive plants can negatively impact native butterflies, and critical associated pollination services (Keeler et al. 2006; Knerl and Bowers 2013; Nakajima et al. 2014; Morton et al. 2015),

and a variety of other critical ecological interactions (Cox 2004). Nonnative invasive plant species can severely degrade virtually ALL of the ecosystem service listed above, and thus are a significant threat to ecosystem stability and related economic well-being and human health. But damage to such critical services has largely been ignored or treated very cursorily in EIS analyses for natural gas pipelines. While environmental impacts from energy wells can certainly be very serious, the massive scale of disturbance created by interstate gas pipelines offers the potential for disturbance or destruction of ecosystem services over a very broad geographic scale (Jones et al. 2015). **Citizens who live along the routes of these massive interstate gas pipelines deserve to have the FERC initiate conscientious and detailed analysis of the potential for massive pipeline projects to damage ecosystem services on which thousands of people rely.** The damages are real and the externalities borne by the citizens are real (Charles and Dukes 2007; Dutzik et al. 2013). The cumulative cascading effects of multiple pipeline projects are not being sufficiently considered when individual projects are assessed (Hunton & Williams LLP 2014; Boshart and Underwood 2015). **Consideration of such cumulative effects is critical, and is specifically required by NEPA** (McCold and Saulsbury 1996).

Why Are Invasive Plant a Particular Threat on Pipeline Rights-of-Way?

Pipeline rights-of-way create environments particularly conducive to the spread of invasive plant species (Miller 2003, 2010a, 2010b; MDC 2015b). Removal of existing vegetation in a wide construction corridor, and extreme soil disturbance and compaction by excavation and construction traffic, create conditions that favor pioneer (early successional) species (FAO 2015; Jones et al. 2015; MDC 2015a; Miller 2010b; Swearingen et al. 2010; USFS 2012; WVDNR 2014; VDCR 2015). The linear nature of the disturbed pipeline corridor allows invasive species to expand quickly, often moved by birds and other animals that favor such habitats (CISC 2014; IPANE 2015). Construction techniques that fail to effectively preserve and replace existing topsoil and its natural structure (FERC 2013) will exacerbate invasive-plant problems even further (CIPC 2012a; Monaco 2012). Common management practices for rights-of-way (including mowing and the use of chemical herbicides) maintain the corridor habitat in an easily invasible form, partly by maintaining edge and shrub habitats that are attractive to animal species that quickly and continually bring propagules of invasive plants from other areas (Yates et al. 2004; Bartuszevige and Gorchov 2006; CIPC 2012b). Additionally, corridor managers typically limit their activities to within the corridor boundaries, and such a limited approach to management will allow deep penetration of invasive plants into the now-fragmented forest (Yates et al. 2004; Brittingham 2015). Once invasive plant species penetrate adjacent non-corridor habitats, those areas will serve as a continual source for corridor reinvasion (and, thus, increased maintenance expense and an increased timeframe where management for invasive plants will be necessary). The original forest structure and composition and even the soil will be changed by the invasive plants, and native vegetation (particularly what had been interior-forest trees) will be negatively impacted or even killed. This will certainly change and likely reduce ecosystem services that had been provided by the native forest, resulting in both the pipeline corridor and a significant amount of native habitat being lost as a source of important services (e.g., erosion protection, watershed protection, environmental resilience, quality of outdoor

recreation, habitat for uncommon or rare species, etc.). Thus, the right-of-way corridor serves to quickly spread invasive plant species along its length, it serves as source for invasives that penetrate and degrade adjacent habitats, and corridor management itself can exacerbate rather than control the spread and persistence of invasive plants species. Numerous agencies have therefore developed stringent 'Best Management Practices' (BMPs) to try to limit the spread of nonnative invasive plants species through utility corridors (e.g., CIPC 2012b; USFS 2012; VISWG 2012; WDNR 2012). **There is no conscionable reason that MVP should not be held stringently to appropriate BMPs, whether that is a "legal" requirement or not. The courts have upheld the authority of the FERC to require stringent management programs for invasive plants (Janasie 2005). In a situation where a private corporation stand to make $ billions in profits, no reasonable environmental protections should be forgone simply because of expense.**

Invasive Plant Species of Particular Concern for the Proposed MVP

There is a long list of very harmful nonnative invasive plants species that already exist in parts of Craig County and neighboring parts of Virginia and West Virginia (Table 1), and construction of the MVP pipeline would rapidly spread these species to parts of the county that are presently uninfected. With the great similarity of habitats in Virginia and West Virginia, these species are very likely to be problems along the MVP pipeline both in Craig County, Virginia, and Monroe County, West Virginia. In fact, many of these species have the ecological potential to invade the entire 300-mile length of the MVP pipeline, and likewise the much longer Atlantic Coast Pipeline (ACP) that is also proposed for elsewhere in the Virginia-West Virginia region. The biological and ecological traits of these invasive plant species virtually guarantee that they will out-compete almost any plant species that MVP employs in restoration efforts. In fact, MVP's proposal to reclaim corridor areas with native grasses and forbs, and to prevent tree regrowth, is completely inappropriate for the soils on steep mountain slopes in Craig County and likely elsewhere on the proposed corridor: **"Most Inceptisols under forested land occur in mountainous regions on slopes ranging from 3 to 90%. On steep terrains, management systems other than natural regrowth are *environmentally unacceptable and practically impossible."*** (page E-253.; Huang et al. 2011). So seeding is an inappropriate management plan for restoration, as is anything other than allowing "natural regrowth." This also means that MVP's long-term maintenance plan to continually restrict tree regrowth is ***"environmentally unacceptable and practically impossible."*** Clearly a pipeline is simply an inappropriate land use for these soils and slopes, and allowing such use would lead to long-term land degradation, soil erosion, and sedimentation to downhill streams that contain sediment-sensitive endangered species.

Corridor management that is inappropriate for the site will further enhance invasion by nonnative plants. Many dozens of nonnative invasive plant species have been identified as problems in the eastern and southeastern USA (Miller 2003, 2010a; Webster et al. 2006; Swearingen, J., et al. 2010; MDC 2015a). One example of potential severe impact is seen with Canada thistle, which more than a decade ago had already infested more than 2 million acres in the eastern USA, and

more than 5 million acres total in our country (Duncan et al. 2004). The scientific literature is full of warnings that soil disturbance such as that which occurs during pipeline construction, and the maintenance of a right-of-way corridor in an early successional state (i.e., no tree cover) will inevitably result in serious land management problems related to invasive plant species. If the plans for the MVP (and other natural gas pipelines proposed for the eastern USA) move forward, we can expect invasion of these pipeline corridors, and then adjacent lands, by numerous invasive plant species. Table 1 (Column 1) lists some of the species that are already known to be extremely problematic in Virginia, in the very areas where the MVP is proposed for construction and operation. Characteristics of these plants that virtually assure widespread land-management problems related to the MVP include the following.

- These plants have a **confirmed high level of invasiveness** in Virginia (see Table 1, Column 2); a "High" invasiveness indicates that the sspecies poses a **significant threat to native species, natural communities or the economy**;

- All of these species have **previously caused invasion problems in all of the habitat types and geographic locations** that the MVP proposes to cross in Virginia(Column 3);

- Almost all of these species are **shade-tolerant**, which makes them particularly suited to invade forest edges and interior-forest habitat that is newly exposed by adjacency to the pipeline corridor(Column 4);

- All of these species have been previously observed to **create serious land-management problems on rights-of-way** and along forest edges (Column 5);

- All of these species can actually **be stimulated and favored rather than controlled by the very management actions (mowing and hand-cutting) that MVP has proposed** to use for corridor maintenance (Column 6);

- In the past, effective control for all but one of these species **has required extensive use of chemical herbicides** (Column 7), which is a management prescription that MVP claims will not be used in this case;

- Likewise, effective control of some of these species is **best accomplished with properly executed prescribed burning** (Column 8; USFS 2015a)**, but such burning would be dangerous and likely would be restricted** on the pipeline corridor (Ohlenbusch and Kunkel 1996).

Table 1: Invasive nonnative plants species that are very likely to be of concern (create long-term management problems) related to the restoration and maintenance of the MVP corridor in Virginia and West Virginia.

1	2	3	4	5	6	7	8
Plant species	Invasiveness rank in VA	High invasive potential in both the mountain and piedmont regions	At least partially shade-tolerant	Documented problem in disturbed-soil areas, rights-of-way and/or forest margins	Invasive potential can be stimulated by mowing or cutting	Herbicides generally required for effective control	Fire can be effectively used as a management tool[y]
Autumn olive *Elaeagnus umbellata*	HIGH[a]	Yes[a]	Yes[c,j]	Yes[c,j]	Yes[c,e,k]	Yes[c,e]	No[e]
Bush honeysuckles *Lonicera spp.*	HIGH-MEDIUM[a]	Yes[a]	Yes[c,f,j]	Yes[c,j]	Yes[c,e,k]	Yes[c,e]	Yes[e]
Canada thistle *Cirsium arvense*	HIGH[a]	Yes[a]	Yes[i]	Yes[i,j]	Yes[e,j,l]	Yes[c,e]	Yes[d,e]
Garlic mustard *Alliaria petiolata*	HIGH[a]	Yes[a]	Yes[j]	Yes[j]	Yes[e,j,l]	No[c,e]	Yes[e]
Japanese stiltgrass *Microstegium vimineum*	HIGH[a,b]	Yes[a,x]	Yes[j,x]	Yes[j]	Yes[n,o]	Yes[c,e]	Mixed reports[t]
Japanese honeysuckle *Lonicera japonica*	HIGH[a]	Yes[a]	Yes[j]	Yes[c,j]	Yes[e,m]	Yes[q,r]	Yes[e]
Multiflora rose *Rosa multiflora*	HIGH[a]	Yes[a]	Yes[j,v]	Yes[c,j]	Yes[e]	Yes[c,e]	Yes[e]
Tall fescue *Festuca arundinacea or Schedonorus phoenix*	HIGH[c]	Yes[c,d,e]	Yes[g,h]	Yes[c,w]	Yes[e]	Yes[e,r]	Yes[e]
Tree-of-heaven *Ailanthus altissima*	HIGH[a,b]	Yes[a]	No[c]	Yes[c,j]	Yes[p]	Yes[s]	No[u]

[a] Heffernan et al. 2014; [b] Also one of twelve invasive species of any taxa rated of highest concern in Virginia by VISWG (2015); [c] Miller 2003, 2010a, 2010b; [d]VNPS 2015; [e]MDC 2015a; [f]Hutchinson et al. 2003; [g]Brosi et al. 2011; [h]Lin et al. 2001; [i]CISC 2014; [j]IPANE 2015; [k]Swearingen et al.; 2010; [l]WDNR 2012; [m]University of Florida 2014; [n]Richardson 2011; [o]MDC 2010; [p]NPS 2015; [q]Nyboer 2015; [r]NPS 2009; [s]VDCR 2009b; [t]Fryer 2011; [u]Fryer 2010; [v]USFS 2006; [w]MDC 2015b; [x]VDCR 2009a; [y]USFS 2015a.

Cascading Environmental, Economic, and Human-Health Effects in Craig County

There is no question that a corridor through Craig County for an excavated gas pipeline would be an agent for the persistent spread of nonnative invasive plants species. The presence of those species along the corridor, and into adjacent private and public lands that they will invade, will create serious environmental disturbance and economic loss in Craig County, and could well have cascading impacts on the health of County residents.

- **Invasive plants affect animal densities:**

  Extensive new "edge" habitat (where two distinct habitats meet, such as a pipeline corridor and forest) will favor certain animal species, including some that in some situations are considered pests (e.g., white-tailed deer, raccoons, possums, skunks, groundhogs, and coyotes). People who live near the pipeline corridor will suffer increased negative interactions with some of these animals, including damage to landscapes and foundations of buildings, livestock and crop depredation, injury and even mortality to companion animals, and possible human exposure to zoonotic diseases (Philo and Wilbert 2000; Ostfeld et al. 2008). Deer in particular will be favored by this altered habitat, and from the pipeline corridor they will penetrate into adjacent forest that was previously interior. Increased deer browsing in the forest will change its ecological character, reduce biodiversity and resilience, and impact ecosystem services (Warren 1991; White 2012; Webster et al. 2006; Nuttle et al. 2013; Pursell et al. 2013). Increased deer activity and less-resilient interior forest will make conditions even more favorable for invasive plants (Andow et al. 1990; Brothers and Spingarn 1992; Collier et al. 2002; Hutchinson et al. 2003; Anderson et al. 2012; TNC 2012), particularly several of those species highlighted to become problematic in Craig County (autumn olive, bush honeysuckle, Japanese stiltgrass, and multiflora rose: Table 1of this document; Meyers et al. 2004; Yates et al. 2004; Williams et al. 2008). White-tailed deer have been shown to spread as many as 500 seeds daily of invasive plants (Williams et al. 2008).

- **Invasive plants, wild animals, and human disease:**

  - Intact forest habitat and animal diversity can play a role in buffering human risk of Lyme disease (CIES 2012).
  - In forest habitats that are uninvaded by nonnative plants, tick densities seem to be more related to population densities of white-footed mice than to deer (Ostfeld et al. 2006).
  - Local deer densities can increase fivefold with the spread of invasive bush honeysuckle (Allan et al. 2010). Simultaneously, ticks infected with several serious diseases that that can infect humans can were ten times as abundant in areas of dense honeysuckle versus more 'native' forest. Effective control of the invasive bush honeysuckle was shown to reduce both deer and tick densities (Allan et al. 2010; OSU 2012).

- Control of invasive Japanese barberry reduced populations of white-footed mice and the black-legged tick (which carries the bacterium that causes Lyme disease in humans) that parasitize the mice (Williams et al. 2009).
- However, tick densities and reports of human Lyme disease in less-natural, human-dominated (suburban) areas show a strong link to deer densities (Kilpatrick et al. 2014).
- Increased densities of invasive plants can alter the dynamics of parasitism and disease in local wildlife populations (Ostfeld et al. 2008). Nonnative landscape plants and invasives in suburban areas may play a role in higher deer densities and Lyme disease incidence.
- An intensive (and expensive) program to actively and continually treat wild deer at "insecticide rubs" resulted in a decrease of reported human cases of Lyme disease in one area of Connecticut (Garnett et al. 2011).

- **Deer and human safety:**

  - Virginia currently ranks in the top 20% of U.S. States for the number of deer-vehicle collisions. The average cost of vehicle damage in such collisions was more than $3,000 in 2012 (Halsey 2012). In a 12-month period of 2006-2007, there were more than 43,000 insurance claims for deer-vehicle collisions in Virginia (VDGIF 2007).

  - The rural-farm nature of Craig County, combined with a high proportion of National Forest lands, create a habitat mosaic with a high proportion of pasture relative to forest habitat. This character of the County already makes it more likely than other counties to have a high density of deer and a high rate of vehicle-deer collisions (Hussain et al. 2007).

  - The rate of deer-vehicle collisions in Craig County [1 per 434 residents]: is more than double the average statewide [1 per 926 residents], and also greatly exceeds the rates in all surrounding counties except one [Botetourt: 1 per 343; Giles: 1 per 627; Montgomery: 1 per 795; Roanoke: 1per 995 (InsideNova 2014).

  - A pipeline corridor in Craig County will create extensive new edge habitat that will likely increase local deer numbers. If invasive plant species are also allowed to spread in the corridor, local deer numbers will increase even more (Williams et al. 2009; Allan et al. 2010).

  - A linear pipeline corridor through Craig County will become a deer-travel corridor that is linked directly to county roads crossed by the pipeline.

- Deer-vehicle collisions and related property damage and human injuries in Craig County will inevitably increase when local deer densities and travel across county roads increase (DeNicola and Williams 2008).

- **Potential effects of herbicides:**

MVP has stated in several public forums that they will avoid using herbicides in the pipeline corridor. But MVP has also stated (in paid newspaper advertisements; see online copy at http://mountainvalleypipeline.info/wp-content/uploads/2015/06/EQT_MVP_Ecological_Resources_Advertorial.pdf) that pipeline-corridor restoration and management will follow recommendations of the Wildlife Habitat Council (WHC: http://www.wildlifehc.org/). WHC regularly recommends tricoplyr and glyphosate herbicides for control of nonnative invasive plants species, including several of the species anticipated to be come problematic on the MVP corridor (Table 1). Such herbicide use could impact ecosystem functions, integrity, and services in Craig County with cascading effects on the County's economy and citizens' health. **The effect of glyphosate on humans is a hotly contested topic (e.g., Williams et al. 2012 and Belle et al. 2012). Many studies are ongoing, and prudence in use of this (and other) herbicide(s) is warranted.**

Broad ecological effects of herbicides

- Repeated applications of glyphosate can reduce respiration by soil microorganisms Zabaloy et al. 2012).

- Earthworms avoid soil in areas treated with glyphosate (Casabé et al. 2007).

- Glyphosate can impact earthworm population ecology (Santadino et al. 2014) and ecosystem services such as soil aeration and water penetration (Zaller et al. 2014).
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- Glyphosate use can reduce populations of beneficial insects (Roy et al. 2003; Schneider et al. 2009; Benamu 2010).

- Spider survival is reduced and arthropod community dynamics changed by glyphosate exposure (Haughton et al. 2001; Evans et al. 2010).

- Dynamics of wetland insects can be changed by glyphosate exposure, and emergence of midges (an insect family that includes some biting flies such as sand flies and black flies) can be increased (Baker et al. 2014).

- Several herbicides have been shown to harm honeybees, particularly if they are combined with oils as surfactants (Moffett and Morton 1975).

- High levels of numerous herbicides and other pesticides have been found in honeybee hives (Mullin et al. 2010).

- Glyphosate can change honeybee behavior, and hive well-being and productivity (Herbert at al. 2014).

- Glyphosate can accumulate to toxic levels in vernal pools (seasonal wetlands) that are critical breeding habitat for amphibians (Battaglin et al. 2008; Jones et al. 2011).

- Some experiments have shown reductions in survival of frog larvae in wetlands treated with glyphosate herbicides, but results have been inconsistent (Edge et al. 2014).

- Exposure to glyphosate herbicides can alter development of wood frogs (a common forest-breeding species in Craig County), although some of the effect may be from surfactants in the herbicide formulation. Some formulations of glyphosate herbicides can cause developmental changes in the development of larval amphibians. Differences in effects might be related to variations in included surfactants (Williams et al. 2012; Howe et al. 2014). The newest surfactant in Roundup® used by the manufacturer is an unknown (proprietary) chemical (Lanctôt et al. 2014).

- In the USA, the Natural Resources Defense Council has filed suit against the EPA, demanding a ban on glyphosate spaying on roadsides and utility rights-of-way to protect the precipitously declining monarch butterfly (NRDC 2015). Such a ban would certainly have implications for pipeline right-of-way maintenance programs.

Concerns about herbicide impacts on food production and safety

- Drift from herbicide applications in the pipeline corridor could drift to neighboring lands (Swayne 2013), and impact farm production and organic certifications.

- Glyphosate residues were detected in honey, corn, and soy products (Rubio et al. 2014).

- Glyphosate residues have been found in the urine of wild animals, farm animals, and humans. Residues found in farmed rabbits were higher than in wild hares, and cows on conventional farms had higher urine levels of glyphosate and metabolites than cows on non-GMO farms (Krüger et al 2014).

- Glyphosate residues were detected in all samples of genetically modified soy beans (Roundup-resistant), but not in organically raised beans, which also had a more-complete nutritional profile than GM beans (Bøhn et al. 2012).

- Glyphosate was recently shown to change the mycobiota (fungi) in the digestive tracts of dairy cows, reduce certain circulating antibodies, thus altering their immune systems in unknown ways (Schrödl et al. 2014).

- Bacteria that are antagonistic to the bacterium that causes botulism are suppressed in the rumen of dairy cows when they are exposed to glyphosate herbicides. This may explain a dramatic increase in botulism-linked disease in German dairy cows over the past decade (Krüger et al. 2013).

- Growth of three beneficial food microorganisms (*Geotrichum candidum*, *Lactococcus lactis cremoris* and *Lactobacillus delbrueckii bulgaricus*) critical as fermentation starters in the dairy industry is reduced by glyphosate herbicides. Pure glyphosate is less toxic than the Roundup formulation to these orgamisms, again indicating that other chemicals in the commercial formulation may contribute to some of the observed effects of glyphosate herbicides (Clair et al. 2012).

- Craig County hosts several of the few remaining dairy farms in the region, which contribute significantly to the County's character and economy. Alternative routes for the MVP pass close to, and in once case across, these farms, and dairy productivity could be impacted by herbicide use on the pipeline corridor.

- Citizens collect a variety of non-timber forest products (NTFPs) on National Forests (McLain and Jones 2005), including various food products. Such use of the National Forest is an integral part of the culture and attachment to place exhibited by Craig County residents, and other communities in the Appalachian region (Hammett and Chamberlain 1999). Some of these food products make their way to commercial markets in the USA and even worldwide. Use of herbicides on the pipeline corridor could leave residues on NTFP food products, thus exposing unsuspecting consumers.

Concerns about herbicides and water supplies

- EVERY resident of Craig County draws their water supply form springs or wells in Craig County that originates in the Jefferson National Forest. These water supplies and, ultimately, the health of citizens could be impacted by herbicide use in the pipeline corridor.

- The herbicide glyphosate and its degradate have been detected in soils, surface water, groundwater, precipitation, and air samples in the USA (Chang et al. 2011; Battaglin et al. 2014; USGS 2014).

- Glyphosate has been detected in groundwater (Sanchis et al. 2011) and surface waters (USGS 2011; Gillam 2011). Some contend that glyphosate leaches to ground waters on a very limited basis dependent on soil type and conditions (Baylis 2000; Borggaard and Gimsing 2008).

- Glyphosate is found in drinking water supplies throughout the USA, which the Environmental Protection Agency (EPA) attributes to surface water runoff from agricultural and other uses (USEPA 2014).

Concerns about herbicides and human health

- Herbicides can cause extreme-sensitivity reactions in some people (USFS 2003).

- Metolachlor (Curwin et al. 2007) and glyphosate (Curwin et al. 2007; Medical Lab of Bremen 2013; Niemann et al. 2015) have been detected in human urine samples.

- Glyphosate is detectable in human blood and urine after ingestion exposure (NPIC 2015).

- Glyphosate was reported in samples of human breast milk Gillam 2014; Honeycutt and Rowlands 2014); the manufacturer of Roundup is disputing and discrediting the independent study that produced these findings.

- Chronically ill humans showed significantly higher glyphosate residues in urine than the healthy population (Krüger et al 2014).

- Phenoxy herbicides (e.g. 2,4-D) have been associated with a number of cancers (Maroni and Fait 1993).

- Some studies link triclopyr to breast cancer, and other vertebrate health issues (NCAP 2000).

- Damage to some in vitro human cells has been demonstrated at concentrations of glyphosate-based herbicides that would be expected in normal environmental residuals (Benachour and Séralini 2009).

- A recent study found that glyphosate can induce in vitro growth of some forms of human breast cancer cells (Thongprakaisang et al. 2013).

- Human birth defects in areas of South America where glyphosate-based herbicides are heavily used are being investigated, and some teratogenic effects of herbicides on vertebrates have been noted (Paganelli et al. 2010).

- In March 2015, the World Health Organization identified glyphosate as a likely human carcinogen (Guyton 2015; IARC 2015). The herbicide has since been declared carcinogenic in Denmark and will be phased out; imports have been halted in Denmark and Bermuda; France has banned it for consumer sale; and several countries (Columbia, El Salvador, Mexico, Netherlands, Russia, and Sri Lanka) have banned the herbicide outright. Brazil is considering a ban of not only glyphosate, but also 2,4-D and some other herbicides as well. The U.S. EPA will release a new risk assessment for glyphosate later this year (Gillam 2014).

- **Economic Threats to Craig County and Landowners**

  - Property values can be decreased by the failure to control nonnative invasive plant species.

    - Farm Credit Services reports loss in agricultural land values due to heavy infestation of invasive nonnative plant species can be as much as 60% [verified in ND] to 83% [verified in Oregon] (Weiser 1997).
    - Aquatic invasive plants caused an average property-value loss of 13% in Wisconsin (Horsch and Lewis 2009), and 16% in Vermont (Zhang and Boyle 2013).
    - The contentions of MVP and the FERC that property values will not be decreased by adjacency to the proposed pipeline are questionable. The most common studies cited to support this contention were published by the industry themselves (INGAA 2001; Diskin et al. 2011). It is generally accepted that environmental externalities affect property values (e.g., highway noise, toxic waste sites; see Kohlhase 1991, Palmquist 1992, Huang and Palmquist 2001, and Kopp and Smith 2013), There is simply discussion about the best approaches to value these externalities. Invasive plant species have the capacity to decrease properties values even further beyond the externality of the pipeline itself. A lack of effective control of invasive species on the MVP will put landowners' investments at risk without suitable mitigation. The FERC must require a more-than-cursory examination, by an independent party, of the influence of both the pipeline and potential nonnative species invasions to reduce property values (per Kopp and Smith 2013).

  - Invasive species can cause reduced economic revenues for agricultural and natural-resources-based industries.

    - USDA estimates that the plague of only a single invasive plant species (leafy spurge) costs ranchers in North Dakota, South Dakota, Montana and Wyoming more than $144 million a year in losses (TNC 2015).
    - Potential economic impacts of nonnatives plants species in Craig County could include loss productivity of grazing lands and forestlands, loss of

agriculture due to effects of corridor herbicide spraying on diaries, orchards, organic farm certifications, and loss of production and/or marketability of nontimber forest products, etc. (all discussed elsewhere in this document).

- Invasive species will create an expensive management problem for private landowners in Craig County and the county itself, and also for the Jefferson National Forest (which is obligated by policy to make concerted efforts to control invasive plants on their lands).

Prevention and Early Detection of Invasive Plant Species

Even the best land management practices may fail to prevent all nonnative invasive plant introductions. However, early detection of introductions and quick, coordinated response can eradicate or contain invasive species at much lower cost than long-term control, which may be infeasible or prohibitively expensive. Invasive species should be detected and dealt with before they become established and spread. An integrated approach involving research and development, technical assistance, and operations is needed to facilitate and implement effective action. No comprehensive national system is in place for detecting and responding to incipient invasions (NISC 2001).

The impact of invasive nonindigenous species on natural areas is likely to be permanent, in part because economic and environmental factors limit eradication or control options that may be appropriate in agricultural settings (NRC 2002). **Thus, prevention of invasion is clearly the best management option in situations where nonnative plant species are known to be in the area, and human disturbance of natural areas is likely to open pathways for further invasion and resultant ecological and economic impacts** (Finnoff et al. 2007; CISM 2014). But land-management plans often shortchange strategies to prevent invasion, in favor of post-invasion control programs that offer an illusion of responsible land-management action. When an invasive plant becomes troublesome, managers' control actions are perceived as active and dedicated efforts to solve the problem, and the manger can point to effort and expenditures as proof of their 'responsible 'actions. In contrast, if the manager had spent funds and effort on preventing the invasion, there is no positive proof that their efforts actually caused a positive outcome (i.e., prevented an invasion that would have occurred without their efforts). Risk-management logic indicates that there is more certainty in control programs than in prevention programs, thus leading managers to the faulty conclusion that their efforts are better spent on planning and executing control programs than prevention programs (Finnoff et al. 2007). In truth, prevention is the most effective (and economical) approach to invasive species management, and should receive at least as much focused attention as post-invasion control programs.

A Critical Need -- A Unified National Approach Regarding Nonnative Invasive Plant Species

Nonnative invasive plant species are one of the greatest threats to croplands, rangelands, aquatic areas, and wildlands in the United States. They degrade the productivity and biological diversity of all ecosystems Greater uniformity and consistency among state and federal regulatory and enforcement agencies, coordinated through an effective national plan, would reduce the potential for invasive weed introductions into the United States and between states into sensitive habitats throughout the nation (CAST 2000).

The purpose of the National Environmental Policy Act (NEPA) is to ensure that environmental factors are weighted equally when compared to other factors in the decision-making process undertaken by federal agencies. The FERC conducts environmental impact analyses for interstate gas pipeline projects under the auspices of NEPA. The rationale behind the NEPA process – that agencies should be fully informed of the consequences of their actions before making a decision – is especially important when dealing with an issue like invasive species, where problems are often unanticipated side effects of seemingly otherwise desirable actions. Analysis and interagency, intergovernmental, and public review and comment that identify potential problems with invasive species for a particular proposed action are of particular importance in the case of pipeline projects, as their linear nature and typical management regimes hold great potential for exacerbating problems with nonnative invasive plants species.

Numerous federal agencies recognize the extremes ecological and economic threats presented by nonnative invasive plant species. Agencies of the U.S. government currently operate under Executive Order 13112 (Invasive Species), which established the now widely used definition of "invasive species" as alien (or nonnative) species that "does or is likely to cause or are likely to cause economic or environmental harm or harm to humans" (NISC 2015). E. O. 13112 directs agencies to take all practical and legal steps to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause (NISC 2015). It also created the National Invasive Species Council (http://www.doi.gov//invasivespecies/index.cfm), which is co-chaired by the directors of the Departments of the Interior, Commerce, and Agriculture. NISC serves to coordinate federal invasive species management efforts among some 35 different agencies and entities within the federal government to ensure that federal programs and activities to prevent and control invasive species are coordinated, effective, and efficient (USDI 2015). The E.O. also directed the Council to develop a national invasive species management plan (e.g., NISC 2001; 2005; 2008).

Virtually all federal land management agencies have developed extensive guidance and Best Management Practices for their agencies in dealing with the serious issues of nonnative invasive plant species on federal lands. Here are some examples:

- U.S. Department of Interior (USDI)
    - National Park Service (Hiebert and Stubbendieck 1993; Swearingen et al. 2010)
    - Bureau of Land Management (BLM 2008, 2011, 2014; FICMNEW 2003)
    - Fish and Wildlife Service (FICMNEW 2003; Swearingen et al. 2010; USFWS 2012, 2013)

- U.S. Department of Energy (USDOE):
- U.S. Department of Agriculture (USDA)
    - Forest Service (FICMNEW 2003; Miller et al. 2010b; USFS 2001, 2005, 2012, 2015b)
    - Animal and Plant Health Inspection Service (APHIS 2010)
    - Natural Resources Conservation Service (NRCS 2007)
- U.S. Department of Defense (DOD 2015)
- U. S. Department of State (USDOS 2015)
- U.S Department of Transportation (USDOT)
    - Federal Highway Administration (USDOT 2000; 2012)

Furthermore, some 16 federal agencies comprise the Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW 2013). This committee fosters collaborative efforts among federal agencies, providing recommendations for national and regional level management of invasive plants. **Given the large acreage of pipeline and other gas-related projects overseen by FERC, the increasing number of these projects being proposed, and the potential for so many of these projects to influence private and public lands and ongoing public agency efforts, it would seem appropriate for the FERC to become an active participant in the FICMNEW.**

Virtually every state in the USA also dedicates significant effort to regulation of and coordination for effective management and control of nonnative invasive plants species, and the development of state and regional plans for attacking this serious environmental and economic threat. For example:

- California Invasive Plant Council (CIPC 2012a, 2012b)
- Maryland Invasive Species Council (MISC 2015)
- New York State Invasive Species Council (NYSISC 2015)
- North Carolina Invasive Plant Council (NCIPC 2015)
- Ohio Invasive Plants Council (OIPC 2015)
- Southeast Exotic Pest Plant Council (SEEPPC 2015)
- Virginia Invasive Species Working Group: VISWG 2012)
- West Virginia Invasive Species Working Group (WVDNR 2014)
- Wisconsin: Best Management Practices for Invasive Species (WDNR 2014)

Many of these state and regional advisory groups include private corporations and trade organizations that represent agriculture, forestry, the energy industry, and other business enterprises that are seriously impacted themselves by invasive species. **If segments of the energy industry that are overseen by the FERC are to be responsible corporate citizens who operate in local communities, then they should take all necessary steps to assure that their operations are not counter to the well-being of local citizens and economies.** Interstate gas pipelines have the potential to cause great economic and environmental damage through the spread of invasive plants specie. Interstate operators of such pipelines should coordinate closely with all local, state, regional, and federal bodies who are seeking to reduce the impacts of

invasive species (Pew Charitable Trusts 2013). Because of the potential for these projects to cause great harm, the FERC should **REQUIRE** such coordination for invasive species monitoring and control.

Significant Efforts Underway to Control Exotic Species in Virginia

In Virginia, we face growing ecological and economic threats from nonnative invasive species to our farmlands, forests, rivers and streams, and quality of life (VDCR 2010; VISWG 2012). Invasive species can significantly reduce the value of ecological services (Charles and Dukes 2007; CISM 2014). The Commonwealth has recognized the threat of invasive species (VISWG 2015), including plants, to our economy and the health and well-being of Virginia's citizens, and created a multi-agency working group to address this growing concern (VISWG 2012; 2015). The Virginia Invasive Species Working Group (VISWG) includes a wide spectrum of state agencies, federal agencies, and conservation organizations active in Virginia, plus Virginia-based agricultural businesses and energy corporations (VDCR 2010). **It would be unconscionable to allow corporate interests behind the Mountain Valley Pipeline, and similarly the Atlantic Coast Pipeline, to undo the concerted efforts of many agencies, corporations, and landowners in Virginia. The FERC should require MVP to effectively coordinate all plans and activities related to invasive plant species with the Virginia Invasive Species Working Group.**

Legal Aspects of Invasive Plant Control in Virginia

Virginia welcomes businesses (http://www.yesvirginia.org/AssetRich), but at the same time its citizens and leaders recognize that protecting the rich natural resources of the Commonwealth helps to preserve the ecosystem services that enhance both the quality of life and the economy in Virginia. For example, the outdoor recreation industry contributes almost $14 billion and 138,000 jobs to Virginia's economy (OIA 2013), but this economic driver is highly dependent on high environmental quality to attract users. Only agriculture and forestry contribute more to Virginia's economy than outdoor recreation, but all three of these industries rely heavily on critical ecosystem services that range from clean and abundant water, to air purification, soil stabilization and protection, and resilient native forest tracts that equally support responsible forestry and attractive scenic views.

Numerous Virginia laws are in place to protect the valuable natural heritage that provides both economic opportunity and high quality of life in Virginia. A number of these laws are specifically aimed at protecting valuable natural heritage from the serious threats of invasive species.

- *Code of Virginia* (2009) § 2.2-220.2 created the Invasive Species Working Group (ISWG), chaired by the Secretary of Natural Resources and vice-chaired by the Secretary of Agriculture and Forestry. The Secretaries are directed to "coordinate the development of strategic actions to be taken by the Commonwealth, individual state

and federal agencies, **private businesses**, and landowners related to invasive species prevention, early detection, rapid response, control and management, research and risk assessment, and education and outreach."

- The Virginia Pest Law (§ 3.2-701) authorizes the Virginia Department of Agriculture and Consumer Services (VDACS) to "protect the agricultural, horticultural, and other interests of the Commonwealth from plant pests."

- The Noxious Weed Law (§ 3.2-800) authorizes the VDACS Board to declare as a "noxious weed… any plant not widely disseminated that is determined to be detrimental to crops, surface waters, including lakes, or other desirable plant, livestock, land, or other property, or to be injurious to the public health or the economy."

Virginia hosts extensive tracts of Federal land, particularly the George Washington and Jefferson National Forests in western Virginia that would be traversed by the MVP and several other proposed interstate gas pipelines. These National Forests are an integral component of Virginia's economy and quality of life. Federal policy protects environmental integrity and ecosystem services on these National Forests. Extensive weed prevention practices are supported by U.S. Forest Service noxious weed policy and strategy. Forest Service policy identifies prevention of the introduction and establishment of noxious weed infestations as an integral agency objective. This policy directs the Forest Service to:

1. Determine the factors that favor establishment and spread of noxious weeds;
2. Analyze weed risks in resource management projects; and
3. Design management practices to reduce these risks.

The Forest Service Noxious Weed Strategy identifies development of practices for prevention and mitigation during ground-disturbing activities, to protect the long-term natural integrity of the National Forests. **The 1999 Executive Order on Invasive Species requires Federal agencies to use relevant programs and authorities to prevent the introduction of invasive species and not authorize or carry out actions that are likely to cause the introduction or spread of invasive species** unless the agency has determined, and made public, documentation that shows that the benefits of such actions clearly outweigh the potential harm, and all feasible and prudent measures to minimize risk of harm will need to be taken in conjunction with the actions (from USFS 2001). This policy has direct implications for both Forest Service and MVP responsibilities for any pipeline corridor that traverses the National Forest. The Forest Service therefore could deny any MVP application that does not include a viable plan to address concerns that a pipeline will spread invasive plant species into the National Forests.

The U.S. Congress recognizes the serious threats of invasive species to environmental integrity of Federal lands, and the value of ecosystem services that originate there. Congress is currently considering the ***Federal Lands Invasive Species Control, Prevention, and Management Act***

(HR 1485), which "directs the Department of the Interior (respecting federal lands administered through the Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, National Park Service, or U.S. Fish and Wildlife Service) and the Department of Agriculture (USDA) (respecting federal lands administered through the U.S. Forest Service) to plan and carry out activities on lands managed by the department concerned to control and manage invasive species in order to inhibit or reduce their populations and to effectuate restoration or reclamation efforts. Requires the department concerned to develop a strategic plan for the implementation of an invasive species program that **endeavors to achieve an annual 5% net reduction of invasive species populations** on lands managed by that department" (from Library of Congress 2015).

Early Detection, Rapid Response, and Effective Control is the Responsibility of MVP

A pipeline will create many problems with nonnative invasive plants species that would not exist otherwise. Therefore, MVP should be responsible to fully analyze the potential for invasive plant problems, and for creating a sound and valid early detection and rapid response (EDRR) plan for invasive plants. Extensive literature and protocols exist to guide such planning (e.g., Hiebert and Stubbendieck 1993; Morse et al. 2004; CICP 2012b; NISIC 2015a, 2015b; Rauschert 2015). Quarles et al. (2011) offers a detailed example of such a plan that is in place for a Federal installation. Landowners and the local government should not be forced to take on this responsibility alone. The problem will be created and exacerbated by pipeline construction and maintenance, so the pipeline company and associated partners and contractors should be responsible for detailed planning to prepare for likely problems with invasive plants species, and they should be responsible for the expense of control programs ***until such time as the pipeline is decommissioned and the ROW corridor is returned to its natural state***.

If MVP and successor companies that are to operate the Mountain Valley Pipeline are going to do business in the Commonwealth of Virginia, they have a corporate responsibility to integrate their planning and operations with the objectives and activities of the VISWG. The FERC should require MVP to meet these responsibilities, by requiring development of detailed and scientifically sound Early Detection and Rapid Response (EDRR) plans for the management of invasive plants species on the MVP corridor, and on all adjacent lands that will be impacted by the project. Such EDRR plans should be developed in close consultation with VISWG.

Financial Bonds Incentivize Good Environmental Practices

Private corporations freely admit that their primary management objective is to maximize profits for company shareholders. This creates a conflict between their obligations to the shareholders and their obligations to the public good. Profit motives logically dictate that environmental programs executed by the company should be done at the least possible cost while still meeting minimum legal requirements.

Environmental-protection oversight for interstate gas pipelines has become a situation that does not necessarily consider the best interests of the American people in protecting the quality of the environment in which they live. Political expediency and other outside factors have led to such energy-development projects being exempted from many environmental protection laws, and even those that do apply do not necessarily carry penalties for violation that make compliance expedient.

Assurance bonds are one way to incentivize good environmental practice (Boyd 2001; Dutzik et al 2013), and such would be appropriate in the case of the Mountain Valley Pipeline. Ferreira and Suslick (2002) present a discussion of several bond types for this purpose. The FERC must analyze the entire financial threat to Craig County (and other regions) presented by the proposed pipeline [project, and set a level of bond assurance that protects citizens form corporate wrongdoing, bankruptcy, etc. An extensive analysis will be required to determine a suitable monetary amount for such a bond, and that analysis must be done by an independent agent with nothing at stake in the decision. As one example related to the much-discussed Keystone Pipeline (which actually is a smaller pipeline than the MVP), operators have been required to post a $100 million environmental assurance bond in the State of Montana alone (Song 2012).

Citizens Need the FERC to Take Decisive Action on Invasive Plant Species

The Federal Energy Regulatory Commission (FERC) has recognized the significant ecological and economic threats posed by invasive aquatic plants (e.g., Janasie 2005; FERC 2014a), and has taken decisive steps to require hydroelectric operators to conduct extensive and long-term monitoring and management programs for invasive aquatic plants (Janasie 2005). But **it seems that the FERC has not required similar due diligence by operators of natural gas facilities, despite the extensive evidence that invasive terrestrial plants can cause extreme and long-term environmental damage and significant economic loss and hardship.** For example, the FERC's recent approval of certificates for construction and operation of the Constitution Pipeline in Pennsylvania and New York (Docket No. CP13-499-000; see FERC 2014c) stated that "adverse environmental impacts. . .will be reduced to less-than-significant levels" through proposed and conditional mitigation measures. Yet those mitigation measures require that invasive plant species only be monitored for a period of 3 years following "successful completion of revegetation." Similarly, the required monitoring for nonnative invasive plants at the Cove Point Liquefaction Project is only 2 years post-construction (EA Engineering 2013). Such short-term requirements ignore the fact that decades can pass between the introduction of an invasive species and the manifestation of its effects (NRC 2002). Seeds of invasive species can be dormant in the soil for many years (D'Antonio and Meyerson 2002; NRCS 2007; Radosovich et al. 2007; Booth et al. 2010), and seeds can be continually dispersed throughout a cleared corridor for as long as the edge habitat exists (Bartuszevige and Gorchov 2006), which may in fact be decades beyond the abandonment of a pipeline.

Regulatory requirements stipulated for natural gas pipeline projects under FERC oversight have the potential to either protect or allow degradation of both private and

public lands. The FERC should recognize the extreme environmental and economic threats posed by potentially inadequate invasive plant management measures required for natural gas pipeline projects that fall under FERC authority, and take steps to insure that FERC oversight includes adequate and effective requirements for pipeline companies to assume full responsibility for invasive plant detection, control, and management on pipeline corridors and nearby lands affected by the pipeline's presence, for the entire timeframe of existence for a pipeline corridor. *Such action falls well within the FERC responsibilities under NEPA, and FERC's stated mission of fostering economic and environmental benefits* (FERC 2014b).

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