



WESTERN MONTANA CORRIDOR

Overview
Volume I

Northwest Advanced Renewables Alliance

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NARA

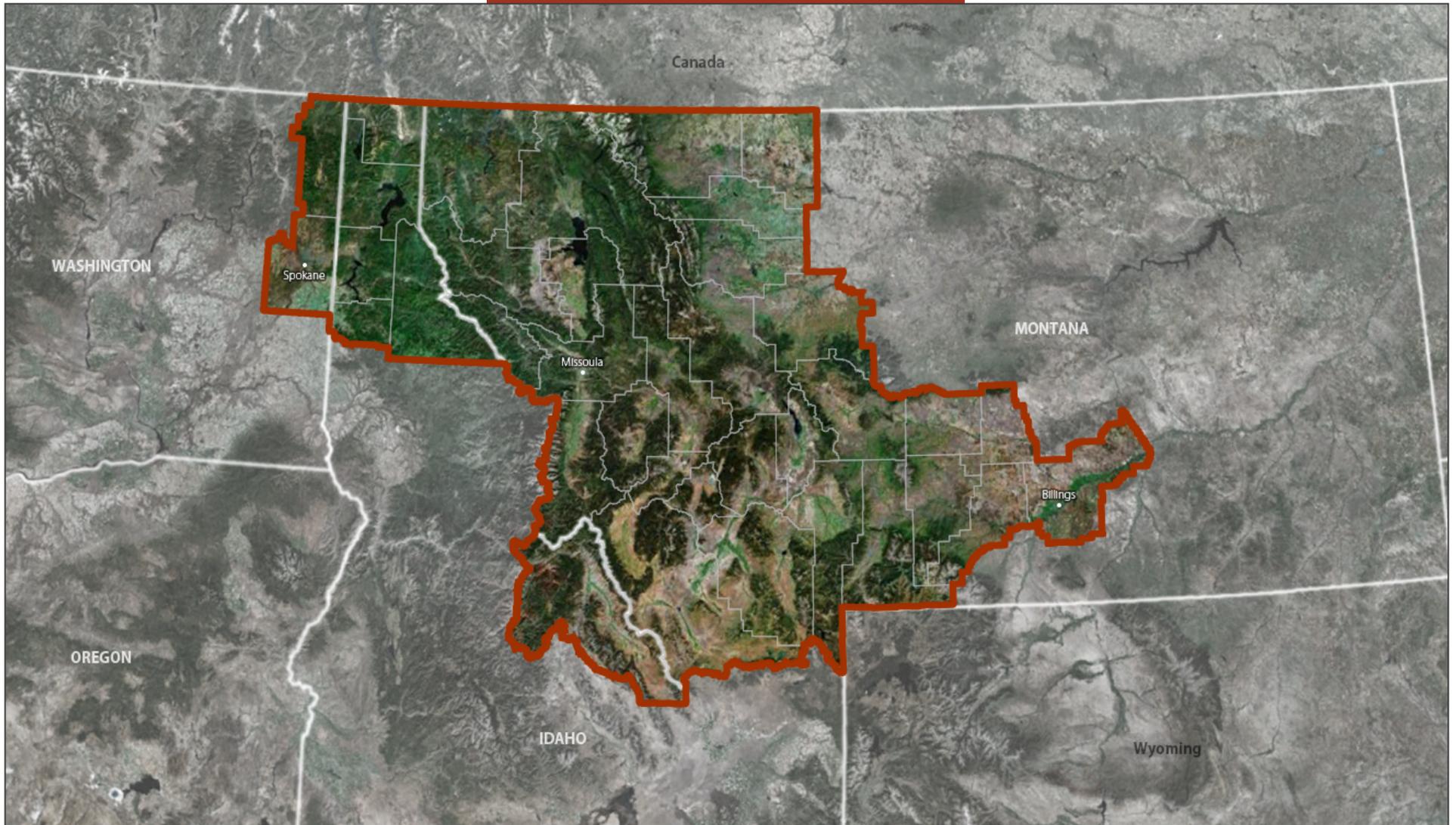


Figure 1.0.1 Western Montana Corridor Region

WESTERN MONTANA CORRIDOR

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ABBREVIATIONS

AFRI	Agriculture and Food Research Initiative program
AHB	Advanced Hardwood Biofuels Northwest
BDT	Bone Dry Tons
Brownfield	Abandoned or underutilized site with real or perceived contamination
CAPS	Coordinated Agricultural Projects
CAAM	Community Asset Assessment Model
C&D	Construction and Demolition Debris
CIA	Community Impact Analysis
CY	Cubic Yard
Greyfield	Vacant or underutilized site with no contamination (e.g., former commercial property)
IDX	Integrated Design Experience
IO	Input-Output Analysis
LCA	Life Cycle Assessment
MRF	Material Recycling Facility
MSW	Municipal Solid Waste
N&E	New and emerging
NARA	Northwest Advanced Renewables Alliance
NIFA	USDA National Institute of Food and Agriculture
OSU	Oregon State University
RFA	Resource Flow Analysis
RWW	Recycled Wood Waste
SLA	Site Location Analysis
TEA	Techno-Economic Analysis
UI	University of Idaho
USFS	United States Forest Service
WMC	Western Montana Corridor
WSU	Washington State University

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SPECIAL THANKS TO OUR WMC CLIENT:

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1.1 Northwest Advanced Renewables Alliance (NARA)

NARA

Northwest Advanced Renewables Alliance

NARA was initiated in 2011. It is one of seven regional bioenergy Coordinated Agricultural Projects (CAPs) within the Sustainable Bioenergy challenge area funded by the USDA National Institute of Food and Agriculture (NIFA) in its Agriculture and Food Research Initiative (AFRI) program. CAPs in Sustainable Bioenergy are charged to:

facilitate the establishment of regional systems for the sustainable production of bioenergy and biobased products that: contribute significantly to reducing the National dependence on foreign oil; have net positive social, environmental, and rural economic impacts; and are integrated with existing agricultural systems (USDA NIFA 2010).

This charge is being addressed through collaborative research, education and workforce development, as well as technology transfer through outreach. Our goal is to integrate research based findings, knowledge of regional resources, and direction provided by regional partners and stakeholders in ways that a sustainable biofuels industry can germinate, take root, become established and flourish in the Pacific Northwest.

1.1.1 Goals and Objectives:

NARA's primary challenge is to envision and facilitate an environmentally, economically, and socially sustainable wood-based biofuels and co-products industry in the Pacific Northwest. NARA's basic task is to develop a viable integrated pathway for commercially producing a bio-based aviation fuel (biojet) (Figure 1.1.1). Towards this end, NARA's five specific goals include:

- Creating sustainable biojet from forest residuals
- Producing value-added polymer and carbon products from lignin to aid in the economic viability of a bio-refinery
- Developing regional pilot supply chains to begin this industry
- Increasing rural economic development
- Enhancing bioenergy literacy for citizens and professionals

1.1.2 Current Status:

In cooperation with NARA members from private industry (e.g. Gevo, Catchlight Energy and Weyerhaeuser), the project has produced an initial techno-economic analysis (TEA) that outlines an integrated bio-refinery operation producing isobutanol and biojet from forest residuals. Assuming bio-refinery construction from scratch (greenfield development) and consumption of 770,000 bone dry tons (BDT) of forest residuals per year, we estimate that about 60 million gallons of biojet would be produced each year from each conversion facility. Based on this scenario, the cost to produce biojet from forest residuals could be two to three times the current market price of petroleum based jet fuel. As overall process refinements are achieved and the price of petroleum derived fuels increase, the price difference should narrow.

1.1.3 Challenge:

Our challenge is to assess regional assets that can be used to improve supply chain efficiencies and result in significant cost reductions. These assets include strategically located industrial facilities in regions with high biomass potential that could host biomass depots, pretreatment processes, fermentation, or alcohol-to-jet refining. These assets could host either a large central bio-refinery or specific components of a distributed production model. In the distributed production approach, existing facilities could produce intermediate products (i.e. refined and sorted biomass, wood-based sugars, isobutanol) that is then concentrated in centralized facilities. At the same time, these distributed operations could help maintain economic scale for other core processes, such as fermentation and conversion of alcohol to biojet fuel at a large bio-refinery. Finally, permitting and related costs might be reduced significantly if bio-refineries are located on previously industrialized sites, either greyfields or brownfields. Greyfields are abandoned or underutilized industrial and commercial facilities available for reuse; however, brownfields may be complicated by environmental contamination. Both types of sites have existing infrastructure present that may expedite the construction of a biofuels operation or may reduce the initial capital construction costs if existing infrastructure can be adapted for biofuels production.

For more information visit the NARA website: nararenewables.org

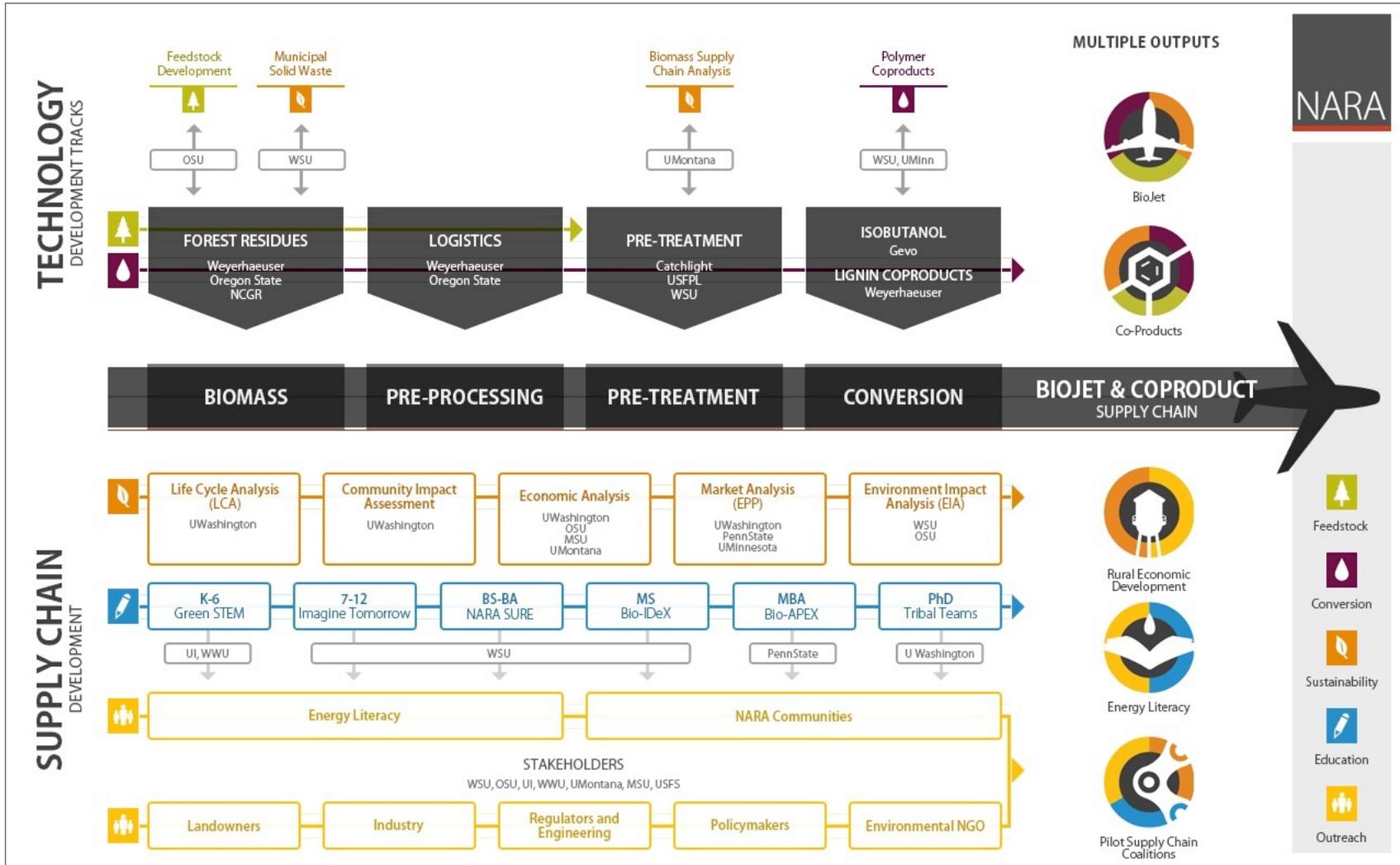


Figure 1.1.1. NARA Structure and Goals

1.2 INTEGRATED DESIGN EXPERIENCE (IDX)

IDX is a collaboration of university courses that contributed much of the information and analyses contained in these volumes. As part of the NARA Education Team, IDX serves a dual role of educating and training the future workforce in sustainable biofuels, and assisting communities with identifying and realizing the opportunities available to them for participating in the biomass to biofuels supply chain.

IDX draws a talented group of undergraduate and graduate students from Washington State University and the University of Idaho who are interested in providing innovative solutions to complex, contemporary challenges. Faculty with expertise in engineering, design, planning, and economics facilitate IDX, which attracts students seeking degrees in engineering (civil, mechanical, environmental), architecture, landscape architecture, bioregional planning, law, environmental science, accounting and several other disciplines.

To view IDX class presentations visit <http://goo.gl/kgdshw>



Figure 1.1.2. NARA Structure and Goals

Seth Cool, University of Idaho graduate student, discusses his IDX work with NARA stakeholders at the Rocky Mountain Elk Foundation in Missoula, MT

1.3 WESTERN MONTANA CORRIDOR (WMC) PROJECT APPROACH

WMC Overview:

The Western Montana Corridor (WMC) encompasses the western half of Montana and parts of northern Idaho and northeastern Washington (Figure 1.1.3).

The geographic scope for the WMC is based on the biomass to biofuels supply chain. In establishing these boundaries, we considered the location of the feedstocks (forest residual), the existing forest industries, the petroleum refining and

distribution capacity (e.g., the Yellowstone pipeline), and location of markets east of the Cascade Mountains where the biofuels will be consumed (e.g., Spokane International Airport and Fairchild Air Force Base). The WMC has significant assets, making it a compelling region for studying a regional biomass to biofuels supply chain.

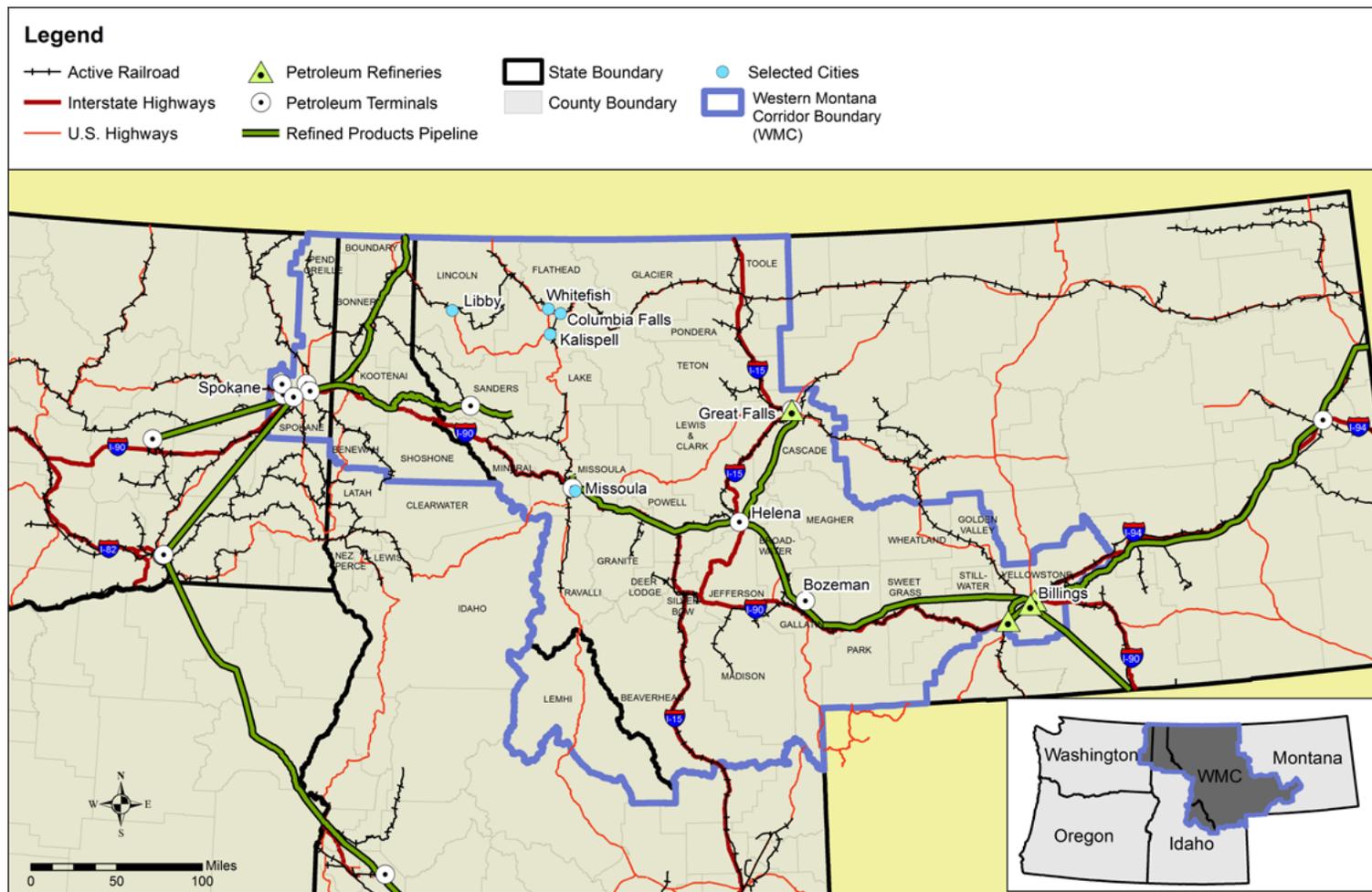


Figure 1.1.3. Western Montana Corridor Map

Western Montana Corridor (WMC) Analyses

To study the WMC supply chain, the Integrated Design Experience (IDX) group, part of the NARA Education team, divided its tasks into three stages outlined in Figure 1.1.4. In the first stage, assets integral to developing a regional supply chain were identified. Volume 2 (WMC Capacity) outlines these assets. The second stage of activity identified case study sites where specific activities along the supply chain could occur, such as preprocessing of forest residues into wood chips or converting chips into isobutanol. In the third stage, conceptual master plans and building designs for the Libby and Frenchtown conversion facilities and four depot sites were developed. These findings are presented in volume 3 (Site Selection and Supply Chain Analysis).

Sustainability analyses for the WMC supply chain study region include a techno-economic analysis (TEA), a preliminary life cycle assessment (LCA), a community impact assessment (CIA) and a regional survey to measure social acceptance. The TEA provides unit costs for all aspects of the supply chain. The LCA and CIA examine environmental and economic impacts of a biomass to biofuels industry to the region. As these sustainability analyses are generated and refined, they become available to the public and are listed in Volume 4 (Sustainability Analyses).

To view a video presentation given by Michael Wolcott, NARA Project Co-Director, and Tammi Lanniga, NARA Education Team Co-PI that describes findings for the WMC, visit <http://goo.gl/CqbgX9>

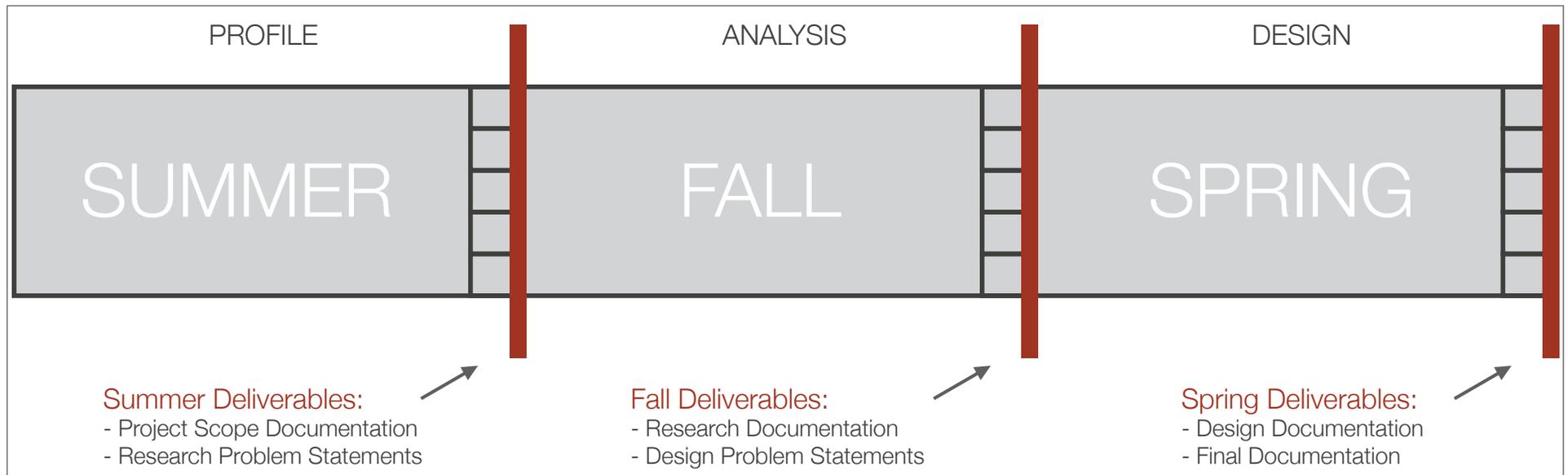


Figure 1.1.4. Project Stages for the WMC Project

1.4 NARA OUTREACH AND ENGAGEMENT

Stakeholders

The NARA Outreach Team and IDX course communicated with a diverse group of individuals and organizations including forestland owner coops, environmental NGOs, business coalitions, regulatory facilitators, biomass working groups, and local, state and federal level policy makers to prepare the findings and analyses presented in the following volumes.

In addition to the broad range of stakeholders, the [Montana Forest Products Retention Roundtable](#) served as a specific client. This group, with broad representation from private industry and public agencies, provided direction, feedback and support to NARA and the IDX students.

Study Timetable

The NARA project hosted a number of meetings in the WMC region during 2012/2013 to meet stakeholders, develop relationships with the Montana Forest Products Retention Roundtable, and to reach out to the general public regarding the project. Below is a list of outreach meetings and presentations given in the WMC.

2012

March 21	Initial NARA Stakeholder Meeting, Missoula, MT
June 13-14	NARA Western Montana Corridor Project Planning Meeting, Missoula, MT
September 13-14	NARA Annual Meeting, Missoula, MT
September 14	NARA Presentation to the Montana Forest Products Retention Roundtable

2013

January 17	NARA Western Montana Corridor Open House
January 18	NARA Presentation to the Montana Forest Products Retention Roundtable
May 10	NARA Presentation to the Montana Forest Products Retention Roundtable
September 6	NARA Presentation to the Montana Forest Products Retention Roundtable

1.5 References

United States Department of Agriculture (USDA) NIFA Agriculture and Food Research Initiative Competitive Grants Program. 2010. Sustainable Bioenergy – 2010 Request for Application. http://www.nifa.usda.gov/funding/rfas/pdfs/10_afri_foundational.pdf (Accessed November 29, 2012).