

Appendix 3: Scenario narratives

The following narratives provide general descriptions of changes to New Hampshire's economy and culture that could change under each scenario: *Backyard*, *Linear*, and the four scenarios in the *Community* family.

Backyard

Rapid population growth is combined with traditional zoning and a rollback of policies and practices to protect natural landscapes and ecosystem services (outside of areas already conserved). The policy and practice of local control dominates in municipalities, the legislature, and courts. Less public money is available for land protection, and environmental statutes and regulations are weakened. New land protection agreements are challenged in court and are increasingly at risk, although no previously conserved land is developed. Financial incentives encourage landowners to make forested and agricultural land available for industrial parks and residential subdivisions.

The primary form of land cover change is residential development, primarily houses adjoining private lawns, gardens, or small wooded lots. Lot sizes are determined by municipal zoning similar to the present day (i.e., one to two acre lots in most communities; Mitchell et al. unpublished report). Housing development occurs primarily in the southeast, an area with easy access to the Boston-metro region. As the southeastern municipalities fill up, development spills northward along major highways (I-89 and 93) and into the southwest and central regions of the state.

Conservation of forests and farmland is reactive, not proactive. As municipalities surpass 50% development, each community undergoes a cultural shift that drives policies to favor cluster zoning (reflecting current trends; Mitchell et al. unpublished report). Cluster zoning supports a decrease in lot sizes, and one to three acres are set aside for conservation for every acre that is developed. Conserved areas are locally managed, with emphasis on recreation and aesthetic values, rather than on other ecosystem services such as wildlife habitat, carbon sequestration, or water supply or flood control.

Residential development occurs primarily outside of urban cores where land costs are lower and municipal services lacking. Homes rely on wells and septic systems rather than municipal water and sewer, and the automobile is the primary form of transportation. Road building does not keep pace with the increase in vehicle miles traveled (VMT); as a result, commuters spend increased time in traffic. Meanwhile, the high cost for municipalities of even the limited road construction and other dispersed infrastructure leaves few resources for other strategic investments. Most economic growth is in the construction and service sectors. There is no state-wide energy plan. Forests cleared in pre-development liquidation harvests provide a one-time source of biomass energy. Lowest cost energy prevails.

The composition of undeveloped land remains similar to the present day, mostly forest with a small amount of agriculture (mostly hay and pasture). Forestry remains highly mechanized, and forestry and agricultural practices focus on short-term profit with reduced emphasis on erosion

mitigation, minimization of fertilizer inputs, or impact on ecosystem services.

Linear

The *Linear* scenario represents a future with economy, practices, and rates of change similar to those over the period from the 1990s to 2010. Preference for local control, resistance to policy change at the municipal level, and traditional business interests are counterbalanced by continued activity by the local and regional land trusts and a growing cultural value of protection of forests, farmland, and ecosystem services, producing a mixture of conventional development and expanding land conservation.

Rates of land cover change among forest, developed, and agricultural categories are held constant at the average rate from 1996 to 2011, and statewide population growth is a linear extrapolation of 1990 to 2010 rates. Rates of land conservation continue linearly as well, but because rates of conservation during the 1996 to 2011 interval were unusually high (Meyer et al. 2014), we assume that those rates of conservation will end by the year 2060. The spatial distribution of land cover change and conservation is shaped by the same drivers as for 1996-2011, and the spatial distribution of the growing population corresponds to the distribution of new development.

Public funding for roads continues to lag behind needs (e.g., Haven 2013), so few new roads are built. There is a modest increase of within-community public transit and public water and sewer, but most residents continue to rely on personal automobiles and wells and septic systems. There are slight expansions in low impact development technologies and the use of renewable energy.

In northern New Hampshire, highly mechanized forestry remains prominent, driven by commercial timber interests. Aside from Best Management Practices to minimize erosion (North East Foresters Association 2013), sustainable forestry practices are rare outside of conserved areas with a specific sustainable timber mission. Uneven-age management with passive regeneration continues to be the norm. Additional timber harvests occur throughout the state where land is cleared in preparation for subdivision development. Agricultural practices are similar to the present day.

Community

In this family of scenarios, public attitudes shift toward valuing collective needs at state and regional scales and away from focus on the particular desires and needs of individuals, aligning with the recommendations of NH's 2009 Climate Action Plan (New Hampshire Climate Policy Task Force 2009). Policies and investment support conservation of land for working forests and agriculture and for the growth of renewable energy. Universal buffer regulations protect wetlands and surface waters across the state. Statewide coordinated policies are implemented to ensure safety, connectivity, and access regardless of age, ability, or mode of transportation.

No additional land is developed beyond what is already developed. Instead, in areas with growing population, urban cores and village centers are redeveloped to accommodate expanding populations. In areas where the population declines, abandoned residences and businesses are

converted into public parks and gardens. Redevelopment to increase density takes various forms, including second houses added to one and two acre lots and construction of apartments, condos, and co-housing in village centers, in alignment with the recent passage of NH Senate Bill 164 (2016) on Accessory Dwelling Units. Most redevelopment uses the principles of low impact design (LID; Roseen et al. 2011), which protects or enhances ecosystem services.

Conservation of forests and farmland is strategic and proactive, with new conservation including rare habitats and corridors between existing conserved land.

Substantial public funds are allocated to building and maintaining public and non-motorized transportation infrastructure between and within population centers. Walking and riding miles increase while VMT decrease, resulting in less congestion, even in growing urban centers. The number of roads therefore does not need to be increased. Concentrated redevelopment also facilitates expansion of public water and sewer because fewer pipe-miles are required to provision additional paying users. Sewage managed by centralized facilities is converted to fertilizer.

Use of sustainably harvested biomass fuels in the state increases, primarily for heating and co-generation facilities. Hydroelectric energy increases in the form of run-of-river and small generators, even as dams are removed to enhance fish habitat. Large tracts of land are set aside for renewable energy projects (biofuel, wind, solar, geothermal).

Forests and farmland are managed to maximize ecosystem services and minimize environmental degradation. Forestry across the state shifts toward more deliberate management – similar to the current management policies in the White Mountain National Forest (USDA 2005) – with different goals in different locations. Location-specific goals could include: maximized wood production, increased carbon storage, habitat connectivity, habitat diversity, erosion minimization, water quality, and flood mitigation. Agricultural land is managed for high productivity, carbon sequestration, well-being of desirable wildlife, and minimized inputs, soil degradation, and runoff. Integrated Pest Management and agroecological methods are emphasized.

Within the *Community* family, population growth and intensity of redevelopment differs between the *Large Community* and *Small Community* variants, and land cover change outside of developed areas differs between the *Food* and *Wildlands* variants (see below). The population scenarios and land cover scenarios can be combined to give a total of four scenarios in the family: *Large Community – Wildlands*, *Small Community – Wildlands*, *Large Community – Food*, and *Small Community – Food*.

Large Community

New Hampshire's population grows rapidly, especially in the more populous towns and cities of the southeastern counties and along major highways. Because no existing forest or farmland is developed, the population densities in these communities increase dramatically, greatly increasing the efficiency of municipal services and freeing financial resources for strategic investments in education and workforce development. The technology sector expands rapidly,

further contributing to the economic, social, and cultural vitality of town centers (Gittell and Orcutt 2012), and attracting young, upwardly-mobile families and aging seniors. The overall scenario reflects a recent demographic trend across America away from suburban sprawl and towards revitalized multi-use pedestrian-friendly urban landscapes (e.g., Ehrenhalt 2012), combined with proactive policies to ensure a high percentage of affordable housing in cities and village centers (Addison et al. 2013, Johnson and Talen 2008).

Small Community

Population growth in the early 21st century is modest, followed by a gradual decline driven by lower fertility rates and an older population (NH OEP 2014). Population change (both positive and negative) primarily occurs in the Southeastern counties (Hillsborough, Rockingham, and Merrimack). For most other counties, the population holds steady, but the population of Coos county declines throughout the century. Community-oriented values promote smart-growth development similar to the *Large Community* scenario, but because the population remains relatively constant the small-town character of New Hampshire municipalities is generally preserved. In areas where the population declines, abandoned residences and box stores are converted into public parks and gardens, producing extensive shared green space or sites for renewable energy to complement improved urban amenities provided by mixed-use zoning and walkable streets. Public water, sewer, and transit expand, but more modestly than in the *Large Community* scenario.

Wildlands

Nearly all undeveloped land remains as forest. There is a modest expansion of agricultural land area, based on a continuation of 1996-2010 trends. Most forests are managed to support sustainable wood harvest, while a minority of forests are protected from most forms of active management, providing areas where forest succession is shaped by natural processes (Foster et al. 2010).

Food

Expansion of agricultural land combines with shifting dietary preferences to increase regional food security and improve the diet of New England residents, as described by Donahue et al. (2014). In accordance with health recommendations, consumption of vegetables, fruit, whole grains, and protein-rich plants increases, while consumption of refined grains, meat, dairy, oils, and discretionary calories decreases. Agricultural land area in New England triples by 2060 and the agricultural land area of New Hampshire more than quadruples in order to meet the target of supporting 50% of New England calories produced within New England.

LITERATURE CITED

- Addison, C., S. Zhang, and B. Coomes. 2013. Smart Growth and Housing Affordability: A Review of Regulatory Mechanisms and Planning Practices. *Journal of Planning Literature* 28(3):215–257.

- Boutin, Cataldo, Feltes, Fuller Clark, Little, Reagan, Watters, Hunt, and Matthews. 2016. Relative to accessory dwelling units. Page SB 146.
- Donahue, B., J. Burke, M. Anderson, A. Beal, T. Kelly, M. Lapping, H. Ramer, R. Libby, and L. Berlin. 2014. *A New England Food Vision*. Page 44. Food Solutions New England.
- Ehrenhalt, A. 2012. *The Great Inversion and the Future of the American City*. First edition. Knopf, New York.
- Foster, D., B. M. Donahue, D. B. Kittredge, K. F. Lambert, M. L. Hunter, B. R. Hall, L. C. Irland, R. J. Lilieholm, D. A. Orwig, A. W. D'Amato, E. A. Colburn, J. R. Thompson, J. N. Levitt, A. M. Ellison, W. S. Keeton, J. D. Aber, C. V. Cogbill, C. T. Driscoll, T. J. Fahey, and C. M. Hart. 2010. *Wildlands and Woodlands: A Vision for the New England Landscape*. Harvard Forest; Harvard University Press, Cambridge, Massachusetts.
- Gittell, R., and J. Orcutt. 2012. *Science and Technology Plan: Shaping New Hampshire's Economic Future*. University of New Hampshire.
- Haven, P. 2013. *Issue Brief: Federal Funding for U.S. Transit and Roadway Infrastructure*. Environmental and Energy Study Institute, Washington, D.C.
- Johnson, J. S., and E. Talen. 2008. Affordable housing in new urbanist communities: A survey of developers. *Housing Policy Debate* 19(4):583--613.
- Meyer, S. R., C. S. Cronan, R. J. Lilieholm, M. L. Johnson, and D. R. Foster. 2014. Land conservation in northern New England: Historic trends and alternative conservation futures. *Biological Conservation* 174:152--160.
- New Hampshire Climate Policy Task Force. 2009. *The New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic Development Future*. Prepared by NH Department of Environmental Services.
- NH Office of Energy and Planning. 2014. *County Population Projections, 2013 by Age and Sex*.
- North East Foresters Association. 2013. *The Economic Importance of New Hampshire's Forest-Based Economy 2013*.
- Rosen, R., T. V. Janeski, J. J. Houle, M. H. Simpson, and J. Gunderson. 2011. *Forging the Link: Linking the Economic Benefits of Low Impact Development with Community Decisions*. UNH Stormwater Center.
- USDA Forest Service. 2005. *Executive Summary of the Final Environmental Impact Statement for the Land and Resource Management Plan: White Mountain National Forest*.