In some respects, the idea of "Planetary Stewardship" is a bit of a misnomer. Stewardship, it seems to me, is deeply rooted in the particulars of a place. To be a good steward, one must have a very clear and specific place or set of things to steward. Now of course, this begs the question, at what scale does one lose the particulars, and I have no ready answer. However, the examples of success and challenges are all rooted in particular places and relationships. I can image talking about a sustainable or healthy planet, but stewarding a planet is not, it seems to me, the sort of thing that is accessible through the act of stewardship. However, it is likely achievable through the compounding benefits of cumulatively successful stewardship efforts at the local level.

Planetary Stewardship Begins at Home

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Cities, and households within cities, are biogeochemical hotspots, because of their consumption of energy, materials, and food, and associated production of air and water pollution. For example, nearly 30% of energy use in the United States is a direct result of household activities, while nearly 60% results from household-related economic activity; only 16% arises from nonhousehold-related consumption activities (Bin and Dowlatabadi 2005). In addition, households make environmentally relevant choices, such as the size of home to purchase and where to live relative to workplaces.

In the Twin Cities Household Ecosystem Project, we have been studying patterns and drivers of household fluxes of carbon (C), nitrogen (N), and phosphorus (P) in Minneapolis-Saint Paul, Minnesota. Total fluxes of C, N, and P (and fluxes from specific contributing activities) were highly variable and often skewed among households, with a small number households contributing disproportionately to total fluxes across all households (Fig. 1 and see Fissore et al. 2011). Carbon fluxes were dominated by

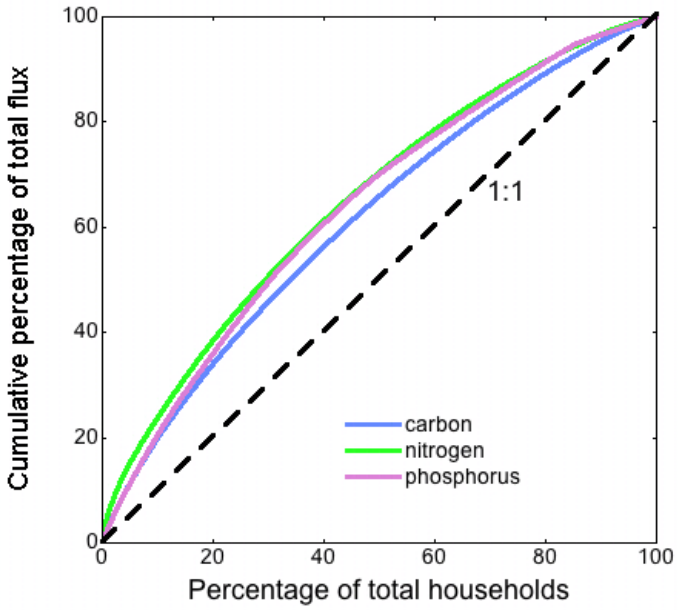

Fig. 1. Cumulative percentage contribution of households to total C, N, and P input fluxes across all households, ranked from highest to lowest contributor. *Notes*: The 1:1 line is also shown, where each household would be contributing equally to the total fluxes. From Fissore et al. 2011.

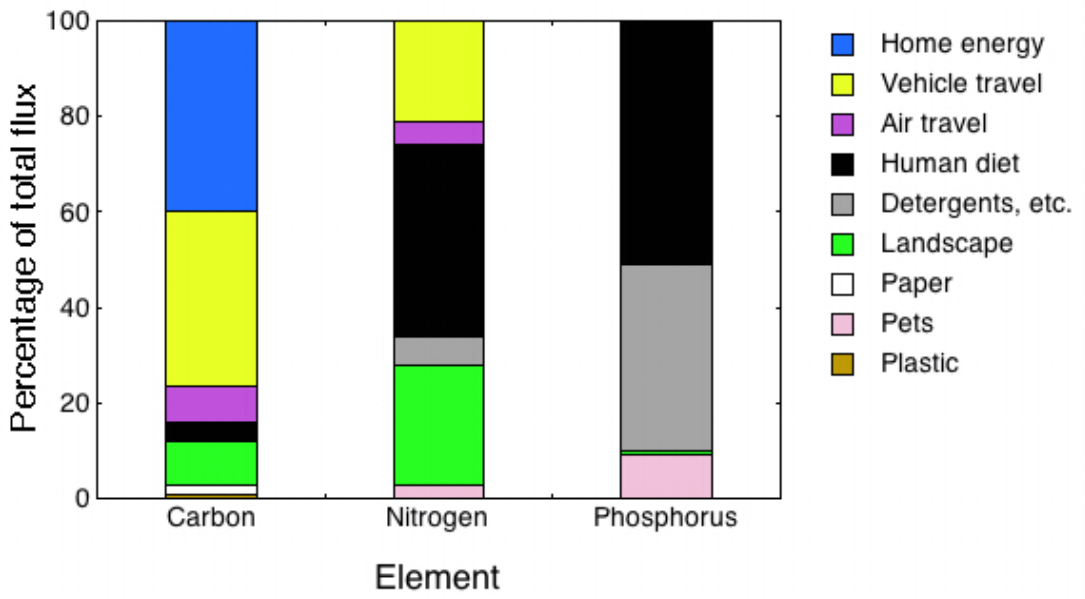

Fig. 2. Relative contribution of different component household activities to total input fluxes of C, N, and P (excluding upstream fluxes involved in production and transportation). Stacked bars sum to 100% of total fluxes. From Fissore et al. 2011.

home energy use, motor vehicle travel, and air travel, each being progressively more skewed among households (Fig. 2 and Fissore et al. 2011). Nitrogen fluxes were dominated by human diet, fossil fuel emissions, and lawn fertilizer, whereas P fluxes were dominated by human diet, detergents, and pet diet (Minnesota restricts P in lawn fertilizer, so we assumed that homeowners did not apply P to their lawns). Thus, these results, together with those of others, indicate that environmentally relevant household activities such as home energy use, air and vehicle travel, and fertilizer use, often are behaviorally flexible (Dietz et al. 2009). In addition, our work supports the notion that fossil fuel use is disproportionately affected by the activities of a relatively small portion of the population, from the scale of counties within countries to the globe (Chakravarty et al. 2009).

Both social and biophysical factors contributed to patterns of household biogeochemical fluxes (Fissore et al. 2011, Nelson et al., *in preparation*). For example, greater household income (as expressed through larger homes, more vehicles, more frequent and longer air travel, and the like) was associated with greater household C fluxes (Nelson et al., *in preparation*). Not surprisingly, households that had longer commute distances had greater vehicle emissions. Less easily quantifiable factors like values, norms, and attitudes also influenced specific behaviors, such as using alternative transportation, rather than a car, for daily trips and maintaining a lawn. For example, people who valued a green, neat, and tidy lawn and who placed importance on what others think were more likely to fertilize their lawn (Nelson et al., *in preparation*). On a personal level, realizing Earth stewardship in urban settings requires that individuals understand the importance of different household activities in affecting urban biogeochemistry. On a larger scale, policies to promote urban (and, ultimately, Earth) stewardship may be most effective if they are informed by knowledge of the social drivers of specific choices (including by households) that influence urban biogeochemistry.

Fig. 3. Planetary stewardship begins at home; how many cars does one household need?

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