cheatgrass communities over the winter months (Table 16) may have been more stress-tolerant (and possibly drought-tolerant) than the fungal communities in native areas.

The ratio of total fungal to total bacterial biomass can be a useful indicator of the degree of disturbance for an ecosystem. Typically, a high fungal to bacterial biomass ratio indicates a stable, undisturbed ecosystem. For example, Grayston et al. (2001) found that a high-fertility, highly managed grassland dominated by *Lolium perenne* supported more bacteria relative to fungi. The readily available carbon sources in this managed community were easily utilized by zymogenous bacteria, as evidenced by high respiration rates. In unmanaged grasslands, native grasses contributed more recalcitrant forms of carbon to the soil organic matter. The proportion of the number of fungi to bacteria was higher in these communities, reflecting fungal ability to breakdown more recalcitrant forms of carbon such as lignin and phenolic compounds.

In our study, fungi began to dominate the microbial biomass during the second summer of decomposition, for all communities (Figure 11). This is curious, given that bacteria may not be able to find the moisture and stability they need to exist above the soil in this arid ecosystem, whereas fungi have a greater ability to break down celluloses and to grow without significant moisture. Our results contrast those of Dilly et al. (2001) who also looked at microbial communities inhabiting tree leaf litter as decomposition proceeded. They found that fungal biomass dominated early in the decay process, with bacteria dominating later. They suggest that fungi were needed for initial breakdown of the litter before bacteria are able to mineralize it. In our study, fungi were less able to establish themselves on fresh litter that was created at the start of the dry summer season. As the rainy season began, fungi grew steadily and became dominant in terms of biomass by the start of the second summer.

The pattern of the ratio of total fungal to total bacterial biomass was similar for all litter species as decomposition proceeded through the seasons (Figure 12). However, native and cheatgrass-dominated litter layers had different microbial dominance dynamics (Figure 11). Within native communities, the fungal to bacterial biomass ratio increased over time and leveled-off over the second summer. In cheatgrass-dominated communities, the ratio declined between November 2001 and January 2002, creating a large difference in the ratios among communities for the January 2002 sampling date. This decline was due to the fact that cheatgrass-dominated communities had a sharp rise in bacterial biomass and only a slight increase in fungal biomass, whereas the native communities had a very large rise in fungal biomass and a slightly smaller rise in bacterial biomass than the cheatgrass-dominated communities. Overall, the shrub community had a significantly greater ratio than the cheatgrass-dominated community, and this was mainly due to their differences in fungal biomass.