GCDAMP Knowledge Assessment: Effects of Management Actions

Resource Topic:	Riparian vegetation
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Resource Characteristic	Specific Measure	Management Action	Strength	Direction	Confidence	Rationale: Strength & Direction	Rationale: Confidence	Recommendations
Total vegetation cover	Sampled total vegetation cover	Fall HFEs > 96-hr duration	Weak	Negative Effect	Low	Floods of this timing, magnitude, and duration may remove woody vegetation below flood stage (31k stage) and partially bury vegetation above this elevation. Species that can reproduce vegetatively (Arrowweed, Baccharis spp., Tamarix spp.) can regrow quickly after floods. Fall HFEs may result in increased winter annual recruitment (Russian thistle). Does not promote cottonwood or willow recruitment. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.	We are confident that vegetation is often not disturbed by HFEs, recovers quickly after HFEs when it is distubed, and that vegetation growth can be promoted by the increased water availability due to HFEs.Particularly long floods may drown some vegetation. We do not know how long an individual flood needs to be to drown vegetation. Previous studies indidcate that over multi-year time periods, inundation for more than 10 % of the time should keep vegetation cover below 12 % (i.e., keep vegetation cover relatively low; hence recommendation)	Although, we do not know how long an individual flood needs to be to drown vegetation, previous studies indicate that over multi-year time periods, inundation for more than 10 % of the given time frame should keep vegetation cover below 12% (i.e., keep vegetation cover relatively low). It is possible, but not certain, that inundating the riparian area for at least 10% of each year may reduce or stop expansion of riparian vegetation. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Total vegetation cover	Sampled total vegetation cover	Fall HFEs ≤ 45,000 cfs in October or November	Weak	Negative Effect	Medium	Floods of this magnitude and duration may remove woody vegetation below flood stage (31k stage) and partially bury vegetation above this elevation. Species that can reproduce vegetatively (Arrowweed, Baccharis spp., Tamarix spp.) can regrow quickly after floods. Fall HFEs may result in increased winter annual recruitment (Russian thistle). Does not promote cottonwood or willow recruitment. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.	We are confident that this size and duration of flood does not remove vegetation. We are confident that vegetation is often not disturbed by HFEs, recovers quickly after HFEs when it is distubed, and that vegetation growth can be promoted by the increased water availability due to HFEs.Particularly long floods may drown some vegetation. We do not know how long an individual flood needs to be to drown vegetation.We suspect that these floods are favoring clonal species, but that has not been studied.	Using genetic studies and field data, we could examine if HFE's are selecting for clonal species and genotypes. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Total vegetation cover	Sampled total vegetation cover	Macroinvertebrate production flows	Weak	Positive Effect	Medium	Similar response to regular flows - vegetation responds similarly to current operating criteria. We expect that these flows are similar enough to current flows that we would not see much change. However, it is possible that low weekend flows could help some species germinate or subject some species to water stress, although it is unclear how likely this is. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.	We expect that these flows are similar enough to current flows that we would not see much change. However, it is possible that low weekend flows could help some species germinate or subject some species to water stress, though it is unclear how likely this is.	We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Total vegetation cover	Sampled total vegetation cover	Proactive Spring HFEs ≤ 45,000 cfs in April, May, or June	Moderate	Positive Effect	Medium	Vegetated area initially reduced through burial, but compensatory response in the growing season may increase woody vegetation growth. Some clonal growth expansion may also increase total vegetated area. Some seed germination may occur at this time period (mesquite/Acacia recruitment?) This flow timing would be most likely to benefit Tamarix, Cottonwood, and Willow. Timing is correct for seed release, but flows may or may not facilitate germination and survival. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.	We are confident that vegetation recovers quickly after HFE's, particularly spring events. We are uncertain about seed germination, but observation suggests that mesquite has had recruitment events after HFE's.	Little information about response to growing season disturbance. Clonal species may be advantaged over seed based reproduction--occupy space made available through burial and some low elevation scour.--Needs to be evaluated. Recruitment potential of different species could be evaluated or we could analyze the response of riparian guilds based on reproductive method (clonal vs. seed). We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Total vegetation cover	Sampled total vegetation cover	Riparian vegetation restoration	Strong	Unknown	Medium	Riparian vegetation restoration can be effective at altering total vegetation cover at the scale of individual restoration sites. However, vegetation rehabilitation sufficient to affect total cover at larger spatial scales would require a substantial investment of resources and intervention at multiple sites. Other disturbances (e.g., from experimental releases) can also alter or override the effects of rehabilitation efforts. Further, the amount of cover created or remaining after restoration actions is controlled by resource management decisions, but riparian vegetation cover will likely increase thereafter without ongoing intervention. Species composition will also likely shift aftr the initial intervention if not maintained through recurring intervention. The driver thus has the potential to strongly affect community heterogeneity, but practical considerations affect confidence that this potential can be realized. As noted in the Status & Trend table, further, rehabilitation to achieve objectives for community heterogeneity would need to be guided by clear objectives for this resource characteristic – objectives that do not yet exist.	Vegetation management at Monument Creek, Granite camp, Lees Ferry, and -6 Mile have provided information about the utility of vegetation alteration.	Develop a science-based vegetation management (e.g., restoration, rehabilitation, or other active management) plan with measureable goals. Allocate time and money based on goals to track success.

Total vegetation cover	Sampled total vegetation cover	Spring HFEs ≤ 45,000 cfs in March or April	Moderate	Positive Effect	Medium	Vegetated area initially reduced through burial, but compensatory response in the growing season may increase woody vegetation growth. Some clonal growth expansion may also increase total vegetated area. Some seed germination may occur at this time period (mesquite/Acacia recruitment?) This flow timing would be most likely to benefit Tamarix, Cottonwood, and Willow. Timing is correct for seed release, but flows may or may not facilitate germination and survival. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.	We are confident that vegetation recovers quickly after HFE's, particularly spring events.	We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Total vegetation cover	Sampled total vegetation cover	Trout management flows	Moderate	Positive Effect	Low	We expect the effect of TMFs on total vegetation cover to be a similar to the effect of other types of HFEs on this resource characteristic, with the effect differing depending on whether the TMF occurred in Spring or Fall, but TMFs are different enough from other HFEs to lower confidence further: Vegetated area initially reduced through burial, but compensatory response in the growing season may increase woody vegetation growth. Some clonal growth expansion may also increase total vegetated area. Some seed germination may occur at this time period (mesquite/Acacia recruitment?) This flow timing would be most likely to benefit Tamarix, Cottonwood, and Willow. Timing is correct for seed release, but flows may or may not facilitate germination and survival. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.		We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Functional group cover	Areal cover of different functional groups, such as broad riparain guilds, species scored for USDA wetland status, etc.	Fall HFEs > 96-hr duration	Moderate	Unknown	Low	Response expected to be similar to that of total vegetation cover (GCMRC is currently studying how flow-response guilds change in relation to different flow regimes): Floods of this timing, magnitude, and duration may remove woody vegetation and bury it. Species that can reproduce vegetatively (Arrowweed, Baccharis spp., Tamarix spp.) can regrow quickly after floods. Fall HFEs may result in increased winter annual recruitment (Russian thistle). Does not promote cottonwood or willow recruitment. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	We do not have results from the flow-response guild project yet, but should this year and next year.	Continue work using flow-response guilds to examine likely functional group changes due to different flow regimes and likely functional group changes that impacted historic sandbar change (two current projects).
Functional group cover	Areal cover of different functional groups, such as broad riparain guilds, species scored for USDA wetland status, etc.	Fall HFEs ≤ 45,000 cfs in October or November	Moderate	Unknown	Low	Response expected to be similar to that of total vegetation cover but expectations for herbaceous vegetation less certain than expectations for woody vegetation (GCMRC is currently studying how flow-response guilds change in relation to different flow regimes): Floods of this timing and magnitude may remove woody vegetation and bury it. Species that can reproduce vegetatively (Arrowweed, Baccharis spp., Tamarix spp.) can regrow quickly after floods. Fall HFEs may result in increased winter annual recruitment (Russian thistle). Does not promote cottonwood or willow recruitment. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	We do not have results from the flow-response guild project yet, but should this year and next year.	Continue work using flow-response guilds to examine likely functional group changes due to different flow regimes and likely functional group changes that impacted historic sandbar change (two current projects).

Functional group cover	Areal cover of different functional groups, such as broad riparain guilds, species scored for USDA wetland status, etc.	Macroinvertebrate production flows	Weak	Unknown	Medium	Response expected to be similar to that of total vegetation cover but expectations for herbaceous vegetation less certain than expectations for woody vegetation (GCMRC is currently studying how flow-response guilds change in relation to different flow regimes): Similar response to regular flows - vegetation responds similarly to current operating criteria. We expect that these flows are similar enough to current flows that we would not see much change. However, it is possible that low weekend flows could help some species germinate or subject some species to water stress, although it is unclear how likely this is. How this will affect functional group composition is unknown.	We do not have results from the flow-response guild project yet, but should this year and next year.	Continue work using flow-response guilds to examine likely functional group changes due to different flow regimes and likely functional group changes that impacted historic sandbar change (two current projects).
Functional group cover	Areal cover of different functional groups, such as broad riparain guilds, species scored for USDA wetland status, etc.	Proactive Spring HFEs ≤ 45,000 cfs in April, May, or June	Moderate	Positive Effect	Medium	Response expected to be similar to that of total vegetation cover but expectations for herbaceous vegetation less certain than expectations for woody vegetation (GCMRC is currently studying how flow-response guilds change in relation to different flow regimes): Vegetated area initially reduced through burial, but compensatory response in the growing season may increase woody vegetation growth. Some clonal growth expansion may also increase total vegetated area. Some seed germination may occur at this time period (mesquite/Acacia recruitment?) This flow timing would be most likely to benefit Tamarix, Cottonwood, and Willow. Timing is correct for seed release, but flows may or may not facilitate germination and survival. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	We do not have results from the flow-response guild project yet, but should this year and next year.	Continue work using flow-response guilds to examine likely functional group changes due to different flow regimes and likely functional group changes that impacted historic sandbar change (two current projects).
Functional group cover	Areal cover of different functional groups, such as broad riparain guilds, species scored for USDA wetland status, etc.	Riparian vegetation restoration	Strong	Unknown	Medium	Response expected to be similar to that of total vegetation cover but expectations for herbaceous vegetation less certain than expectations for woody vegetation (GCMRC is currently studying how flow-response guilds change in relation to different flow regimes): Amount is controlled by resource management, but without continued management riparian vegetation cover will likely increase. Species composition will likely shift if not maintained. How this will affect functional group composition is unknown.	We do not have results from the flow-response guild project yet, but should this year and next year.	Continue work using flow-response guilds to examine likely functional group changes due to different flow regimes and likely functional group changes that impacted historic sandbar change (two current projects).

Functional group cover	Areal cover of different functional groups, such as broad riparain guilds, species scored for USDA wetland status, etc.	Spring HFEs ≤ 45,000 cfs in March or April	Moderate	Positive Effect	Medium	Response expected to be similar to that of total vegetation cover but expectations for herbaceous vegetation less certain than expectations for woody vegetation (GCMRC is currently studying how flow-response guilds change in relation to different flow regimes): Vegetated area initially reduced through burial, but compensatory response in the growing season may increase woody vegetation growth. Some clonal growth expansion may also increase total vegetated area. Some seed germination may occur at this time period (mesquite/Acacia recruitment?) This flow timing would be most likely to benefit Tamarix, Cottonwood, and Willow. Timing is correct for seed release, but flows may or may not facilitate germination and survival. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	We do not have results from the flow-response guild project yet, but should this year and next year.	Continue work using flow-response guilds to examine likely functional group changes due to different flow regimes and likely functional group changes that impacted historic sandbar change (two current projects).
Functional group cover	Areal cover of different functional groups, such as broad riparain guilds, species scored for USDA wetland status, etc.	Trout management flows	Moderate	Positive Effect	Low	We expect the effect of TMFs on functional group cover to be a similar to the effect of other types of HFEs on this resource characteristic, with the effect differing depending on whether the TMF occurred in Spring or Fall, but TMFs are different enough from other HFEs to lower confidence (GCMRC is currently studying how flow-response guilds change in relation to different flow regimes): Vegetated area initially reduced through burial, but compensatory response in the growing season may increase woody vegetation growth. Some clonal growth expansion may also increase total vegetated area. Some seed germination may occur at this time period (mesquite/Acacia recruitment?) This flow timing would be most likely to benefit Tamarix, Cottonwood, and Willow. Timing is correct for seed release, but flows may or may not facilitate germination and survival. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	We do not have results from the flow-response guild project yet, but should this year and next year.	Continue work using flow-response guilds to examine likely functional group changes due to different flow regimes and likely functional group changes that impacted historic sandbar change (two current projects).

Area of herbaceous marsh habitats	Areal cover of herbaceous marsh vegetation, digital imagery polygons	Fall HFEs > 96-hr duration	Weak	Unknown	Low	Sediment grainsize may coarsen and affect water/nutrient holding capacity causing shift in plant functional group representation. Clonal species may increase. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	There has not been any research conducted on the impacts of HFE's on marsh habitats.	
Area of herbaceous marsh habitats	Areal cover of herbaceous marsh vegetation, digital imagery polygons	Fall HFEs ≤ 45,000 cfs in October or November	Weak	Unknown	Low	Sediment grainsize may coarsen and affect water/nutrient holding capacity causing shift in plant functional group representation. Clonal species may increase. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	There has not been any research conducted on the impacts of HFE's on marsh habitats.	
Area of herbaceous marsh habitats	Areal cover of herbaceous marsh vegetation, digital imagery polygons	Macroinvertebrate production flows	Moderate	Unknown	Low	Similar response to present-day non-HFE flow routine - regular inundation should favor marsh habitat if the substrate is sufficiently small. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	While the flows between 1983 and 1991 increased marsh vegetation, the impacts of current flows on marsh vegetation is unknown.	

Area of herbaceous marsh habitats	Areal cover of herbaceous marsh vegetation, digital imagery polygons	Proactive Spring HFEs ≤ 45,000 cfs in April, May, or June	Moderate	Unknown	Low	Marsh vegetation covers its greatest extent in the fall, but initial cover may be measurable in the June. Late Spring floods may increase wetted area and promote seed dispersal and germination. Spring HFEs may increase nutrient availability for the growing season. Sediment grainsize may coarsen and affect water/nutrient holding capacity causing shift in plant functional group representation. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	The current impacts of flows on marsh vegetation is unknown.	Study functional group response/shifts and model using flow scenario
Area of herbaceous marsh habitats	Areal cover of herbaceous marsh vegetation, digital imagery polygons	Riparian vegetation restoration	Strong	Positive Effect	Low	As stated in the Drivers/Constraints table, vegetation rehabilitation can be effective for managing herbaceous marsh habitats at the scale of individual restoration sites, although such work requires supplementing substrates with fine grain substrates (see separate driver) and careful attention to the amount of inundation. However, such efforts have not been carried out or studied in the CRe. Human removal or planting of species can have a large impact on herbaceous marsh habitats in the short and medium time scales. However, without ongoing direct human intervention, the effects of dam operations can override the effects of site rehabilitation. Other disturbances also can alter or override the effects of rehabilitation efforts. As noted in the Status & Trend table, further, rehabilitation to achieve objectives for herbaceous marsh habitats would need to be guided by clear objectives for this resource characteristic, which do not yet exist.	Creating and maintaining herbaceous marsh habitats has not been done or studied, but there has been success in replanting native woody shrubs/trees at Granite camp and -6 Mile (Hidden Slough).	Develop a science-based vegetation management (e.g., restoration, rehabilitation, or other active management) plan with measureable goals. Allocate time and money based on goals to track success.
Area of herbaceous marsh habitats	Areal cover of herbaceous marsh vegetation, digital imagery polygons	Spring HFEs ≤ 45,000 cfs in March or April	Moderate	Unknown	Low	Marsh vegetation covers its greatest extent in the fall, but initial cover may be measurable in the June. Late Spring floods may increase wetted area and promote seed dispersal and germination. Spring HFEs may increase nutrient availability for the growing season. Sediment grainsize may coarsen and affect water/nutrient holding capacity causing shift in plant functional group representation. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	The current impacts of flows on marsh vegetation is unknown.	

Area of herbaceous marsh habitats	Areal cover of herbaceous marsh vegetation, digital imagery polygons	Trout management flows	Moderate	Unknown	Low	We expect the effect of TMFs on the area of herbaceous habitats to be a similar to the effect of other types of HFEs on this resource characteristic, with the effect differing depending on whether the TMF occurred in Spring or Fall, but TMFs are different enough from other HFEs to lower confidence: Marsh vegetation covers its greatest extent in the fall, but initial cover may be measurable in the June. Late Spring floods may increase wetted area and promote seed dispersal and germination. Spring HFEs may increase nutrient availability for the growing season. Sediment grainsize may coarsen and affect water/nutrient holding capacity causing shift in plant functional group representation. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	The current impacts of flows on marsh vegetation is unknown.	
Area of woody vegetation	Areal cover of woody vegetation, digital imagery polygons	Fall HFEs > 96-hr duration	Weak	Negative Effect	Low	Floods of this timing, magnitude, and duration may remove woody vegetation below flood stage (31k stage) and partially bury vegetation above this elevation. Species that can reproduce vegetatively (Arrowweed, Baccharis spp., Tamarix spp.) can regrow quickly after floods. Fall HFEs may result in increased winter annual recruitment (Russian thistle). Does not promote cottonwood or willow recruitment. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.	Particularly long floods may drown some vegetation. We do not know how long an individual flood needs to be to drown vegetation. Previous studies indicate that over multi-year time periods, inundation for more than 10 % of the time should keep vegetation cover below 12 % (i.e., keep vegetation cover relatively low; hence recommendation)	We could study the functional group respons/shifts and model the probabilities of occurance using flow scenarios. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species. Although, we do not know how long an individual flood needs to be to drown vegetation, previous studies indicate that over multi-year time periods, inundation for more than 10 % of the given time frame should keep vegetation cover below 12% (i.e., keep vegetation cover relatively low). It is possible, but not certain, that inundating the riparian area for at least 10% of each year may reduce or stop expansion of riparian vegetation.
Area of woody vegetation	Areal cover of woody vegetation, digital imagery polygons	Fall HFEs ≤ 45,000 cfs in October or November	Weak	Negative Effect	Low	Floods of this magnitude and duration do not remove woody vegetation, just bury it. Species that can reproduce vegetatively (Arrowweed, Baccharis spp., Tamarix spp.) can regrow quickly after floods. Fall HFEs may result in increased winter annual recruitment (Russian thistle). Does not promote cottonwood or willow recruitment. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.	We are confident that this size and duration of flood does not remove vegetation. We are confident that vegetation is often not disturbed by HFEs, recovers quickly after HFEs when it is distubed, and that vegetation growth can be promoted by the increased water availability due to HFEs.We suspect that these floods are favoring clonal species, but that has not been studied. Melis et al., 2011; Ralston 2008; Sankey et al., 2015	Using genetic studies and field data, we could examine if HFE's are selecting for clonal species and genotypes. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Area of woody vegetation	Areal cover of woody vegetation, digital imagery polygons	Macroinvertebrate production flows	Weak	Positive Effect	Medium	Similar response to regular flows – woody vegetation responds similarly to current operating criteria. We expect that these flows are similar enough to current flows that we would not see much change. However, it is possible that low weekend flows could help some species germinate or subject some species to water stress, although it is unclear how likely this is.	We expect that these flows are similar enough to current flows that we would not see much change.	We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Area of woody vegetation	Areal cover of woody vegetation, digital imagery polygons	Proactive Spring HFEs ≤ 45,000 cfs in April, May, or June	Moderate	Positive Effect	Medium	Vegetated area initially reduced through burial, but compensatory response in the growing season may increase woody vegetation growth. Some clonal growth expansion may also increase total vegetated area. Some seed germination may occur at this time period (mesquite/Acacia recruitment?) This flow timing would be most likely to benefit Tamarix, Cottonwood, and Willow. Timing is correct for seed release, but flows may or may not facilitate germination and survival. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.	We are confident that vegetation is often not disturbed by HFEs, recovers quickly after HFEs when it is distubed (particularly spring events), and that vegetation growth can be promoted by the increased water availability due to HFEs.We are uncertain about seed germination, but observation suggests that mesquite has had recruitment events after HFE's.	Little information about response to growing season disturbance. Clonal species may be advantaged over seed based reproduction--occupy space made available through burial and some low elevation scour.--Needs to be evaluated. Recruitment potential of different species could be evaluated. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Area of woody vegetation	Areal cover of woody vegetation, digital imagery polygons	Riparian vegetation restoration	Strong	Unknown	Medium	Amount is controlled by resource management, but without continued management riparian vegetation cover will likely increase. Species composition will likely shift if not maintained.	Vegetation management at Monument Creek, Granite camp, Lees Ferry, and -6 Mile have provided information about the utility of vegetation alteration.	Develop a science-based vegetation management (e.g., restoration, rehabilitation, or other active management) plan with measureable goals. Allocate time and money based on goals to track success.
Area of woody vegetation	Areal cover of woody vegetation, digital imagery polygons	Spring HFEs ≤ 45,000 cfs in March or April	Moderate	Positive Effect	Medium	Vegetated area initially reduced through burial, but compensatory response in the growing season may increase woody vegetation growth. Some clonal growth expansion may also increase total vegetated area. Some seed germination may occur at this time period (mesquite/Acacia recruitment?) This flow timing would be most likely to benefit Tamarix, Cottonwood, and Willow. Timing is correct for seed release, but flows may or may not facilitate germination and survival. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.	We are confident that vegetation is often not disturbed by HFEs, recovers quickly after HFEs when it is distubed (particularly spring events), and that vegetation growth can be promoted by the increased water availability due to HFEs.	We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Area of woody vegetation	Areal cover of woody vegetation, digital imagery polygons	Trout management flows	Moderate	Positive Effect	Low	We expect the effect of TMFs on the area of woody vegetation cover to be a similar to the effect of other types of HFEs on this resource characteristic, with the effect differing depending on whether the TMF occurred in Spring or Fall, but TMFs are different enough from other HFEs to lower confidence: Vegetated area initially reduced through burial, but compensatory response in the growing season may increase woody vegetation growth. Some clonal growth expansion may also increase total vegetated area. Some seed germination may occur at this time period (mesquite/Acacia recruitment?) This flow timing would be most likely to benefit Tamarix, Cottonwood, and Willow. Timing is correct for seed release, but flows may or may not facilitate germination and survival. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, except that particularly long floods may drown some vegetation.		We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Community heterogeneity	Number of community types/river mile (high Beta diversity)	Fall HFEs > 96-hr duration	Unknown	Unknown	Low	General uncertainty about how regulated flows can affect community heterogeneity in the long-term. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Community heterogeneity	Number of community types/river mile (high Beta diversity)	Fall HFEs ≤ 45,000 cfs in October or November	Unknown	Unknown	Low	General uncertainty about how regulated flows can affect community heterogeneity in the long-term. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Community heterogeneity	Number of community types/river mile (high Beta diversity)	Macroinvertebrate production flows	Unknown	Unknown	Low	General uncertainty about how regulated flows can affect community heterogeneity in the long-term. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Community heterogeneity	Number of community types/river mile (high Beta diversity)	Proactive Spring HFEs ≤ 45,000 cfs in April, May, or June	Unknown	Unknown	Low	General uncertainty about how regulated flows can affect community heterogeneity in the long-term. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Community heterogeneity	Number of community types/river mile (high Beta diversity)	Riparian vegetation restoration	Unknown	Unknown	Low	Response expected to be similar to that of total vegetation cover but expectations for community heterogeneity less certain than expectations for total vegetation, woody vegetation, and functional group composition (GCMRC is currently studying how flow-response guilds change in relation to different flow regimes): Vegetation at restoration sites is controlled by resource management decisions or their absence: Species composition will likely shift if not maintained. How this will affect community heterogeneity is unknown.	Vegetation management at Monument Creek, Granite camp, Lees Ferry, and -6 Mile have provided information about the utility of vegetation alteration.	Develop a science-based vegetation management (e.g., restoration, rehabilitation, or other active management) plan with measureable goals. Allocate time and money based on goals to track success.
Community heterogeneity	Number of community types/river mile (high Beta diversity)	Spring HFEs ≤ 45,000 cfs in March or April	Unknown	Unknown	Low	General uncertainty about how regulated flows can affect community heterogeneity in the long-term. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Community heterogeneity	Number of community types/river mile (high Beta diversity)	Trout management flows	Unknown	Unknown	Low	General uncertainty about how regulated flows can affect community heterogeneity in the long-term. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Native to non-native ratio	Proportion of native to non-native species cover	Fall HFEs > 96-hr duration	Weak	Unknown	Low	Fall HFEs would largely favor annual non-native species such as Bromus spp. and Russian thistle rather than perennial species. It could also favor clonal non-native species, such as Camelthorn.	We have not studied how HFE's affect the composition of riparian vegetation. A few studies looked specifically at one or two species responses.	We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Native to non-native ratio	Proportion of native to non-native species cover	Fall HFEs ≤ 45,000 cfs in October or November	Unknown	Unknown	Low	Fall HFEs would largely favor annual non-native species such as Bromus spp. and Russian thistle rather than perennial species. It could also favor clonal non-native species, such as Camelthorn.	We have not studied how HFE's affect the composition of riparian vegetation. A few studies looked specifically at one or two species responses.	We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Native to non-native ratio	Proportion of native to non-native species cover	Macroinvertebrate production flows	Weak	Unknown	Low	Similar response to regular flows - vegetation responds similarly to current operating criteria (see Status/Trend table). There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Native to non-native ratio	Proportion of native to non-native species cover	Proactive Spring HFEs ≤ 45,000 cfs in April, May, or June	Weak	Unknown	Low	Spring HFEs could positively influence both native and non-native species, which could shift proportions in either direction. However, the short duration of the current HFEs will primarily benefit annuals rather than perennials, regardless of whether native or non-native. HFEs in this season period would most likely result in germination of Tamarix spp. If frequency of disturbance (annual) supports a functional group that is dominated by non-native species then there may be a tipping point where nonnative species are in greater numbers. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	We have not studied how HFE's affect the composition of riparian vegetation. A few studies looked specifically at one or two species responses.	Use flow scenarios and modeling to identify vulnerable and resilient functional groups. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Native to non-native ratio	Proportion of native to non-native species cover	Riparian vegetation restoration	Strong	Positive Effect	Medium	Vegetation at restoration sites is controlled by resource management decisions or their absence: Removal of non-natives will likely be an objective at many restoration sites, resulting in increased native species cover, but keeping non-native numbers or cover down over the long term will require repeated interventions except where Tamarisk beetle is active.	Vegetation management at Monument Creek, Granite camp, Lees Ferry, and -6 Mile have provided information about the utility of vegetation alteration.	What to do with the dead, standing Tamarix may be a topic to consider in the future. Develop a science-based vegetation management (e.g., restoration, rehabilitation, or other active management) plan with measureable goals. Allocate time and money based on goals to track success.
Native to non-native ratio	Proportion of native to non-native species cover	Spring HFEs ≤ 45,000 cfs in March or April	Weak	Unknown	Low	Spring HFEs could positively influence both native and non-native species, which could shift proportions in either direction. However, the short duration of the current HFEs will primarily benefit annuals rather than perennials, regardless of whether native or non-native. HFEs in this season period would most likely result in germination of Tamarix spp. If frequency of disturbance (annual) supports a functional group that is dominated by non-native species then there may be a tipping point where nonnative species are in greater numbers. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	We have not studied how HFE's affect the composition of riparian vegetation. A few studies looked specifically at one or two species responses.	We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Native to non-native ratio	Proportion of native to non-native species cover	Trout management flows	Unknown	Unknown	Low	We expect the effect of TMFs on the native to non-native ratio to be a similar to the effect of other types of HFEs on this resource characteristic, with the effect differing depending on whether the TMF occurred in Spring or Fall, but TMFs are different enough from other HFEs to lower confidence: There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	We have not studied how HFE's affect the composition of riparian vegetation. A few studies looked specifically at one or two species responses.	We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Species richness	Number of plant species	Fall HFEs > 96-hr duration	Weak	Unknown	Low	Fall HFEs > 96-hr duration would most likely result in an increase in winter and spring annuals, possibly with native species generation. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	The impacts of regulated flows on species richness has not been studied in Grand Canyon.	While this is a popular measure of ecosystem health, it can be quite variable and difficult to tie to specific ecological goals. It is easy to calculate measures of richness based on our current sampling protocol, but minor to medium fluctuations in richness need to be evaluated cautiously. Large changes in richness over time would indicate systemic change, and could be investigated further for causes. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Species richness	Number of plant species	Fall HFEs ≤ 45,000 cfs in October or November	Weak	Unknown	Low	Fall HFEs ≤ 45,000 cfs in October or November would most likely result in an increase in winter and spring annuals, possibly with native species generation. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	The impacts of regulated flows on species richness has not been studied in Grand Canyon.	While this is a popular measure of ecosystem health, it can be quite variable and difficult to tie to specific ecological goals. It is easy to calculate measures of richness based on our current sampling protocol, but minor to medium fluctuations in richness need to be evaluated cautiously. Large changes in richness over time would indicate systemic change, and could be investigated further for causes. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Species richness	Number of plant species	Macroinvertebrate production flows	Weak	Unknown	Low	Similar response to regular flows - vegetation responds similarly to current operating criteria. We expect that these flows are similar enough to current flows that we would not see much change. However, it is possible that low weekend flows could help some species germinate or subject some species to water stress, although it is unclear how likely this is. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	The impacts of regulated flows on species richness has not been studied in Grand Canyon.	While this is a popular measure of ecosystem health, it can be quite variable and difficult to tie to specific ecological goals. It is easy to calculate measures of richness based on our current sampling protocol, but minor to medium fluctuations in richness need to be evaluated cautiously. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Species richness	Number of plant species	Proactive Spring HFEs ≤ 45,000 cfs in April, May, or June	Moderate	Positive Effect	Low	Studies in other river systems have found spring floods to be beneficial to riparian plants. Limited research in Grand Canyon suggests that some limited recruitment takes place after flooding. Disturbance in growing season may support perennial species, summer annuals (Bromus sp.), and possibly Cottonwood/Willow/Tamarisk. Little information about response to growing season disturbance. Clonal species may be advantaged over seed based reproduction--occupy space made available through burial and some low elevation scour, but this has not been studied. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	Disturbance in growing season may support perennial species, summer annuals (Bromus sp.), and possibly Cottonwood/Willow/Tamarisk. Little information about response to growing season disturbance. Clonal species may be advantaged over seed based reproduction--occupy space made available through burial and some low elevation scour, but this has not been studied.	While this is a popular measure of ecosystem health, it can be quite variable and difficult to tie to specific ecological goals. It is easy to calculate measures of richness based on our current sampling protocol, but minor to medium fluctuations in richness need to be evaluated cautiously. Large changes in richness over time would indicate systemic change, and could be investigated further for causes. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Species richness	Number of plant species	Riparian vegetation restoration	Strong	Unknown	Medium	Response of species richness to restoration efforts is expected to be similar to that of other riparian vegetation characteristics: Vegetation at restoration sites is controlled by resource management decisions or their absence: Species composition will likely shift from that established during restoration work if not maintained. How this will affect species richness is unknown, since it will depend on restoration decisions made at each restoration site.	Vegetation management at Monument Creek, Granite camp, Lees Ferry, and -6 Mile have provided information about the utility of vegetation alteration.	Develop a science-based vegetation management (e.g., restoration, rehabilitation, or other active management) plan with measureable goals. Allocate time and money based on goals to track success.
Species richness	Number of plant species	Spring HFEs ≤ 45,000 cfs in March or April	Moderate	Positive Effect	Low	Studies in other river systems have found spring floods to be beneficial to riparian plants. Limited research in Grand Canyon suggests that some limited recruitment takes place after flooding. Disturbance in growing season may support perennial species, summer annuals (Bromus sp.), and possibly Cottonwood/Willow/Tamarisk. Little information about response to growing season disturbance. Clonal species may be advantaged over seed based reproduction--occupy space made available through burial and some low elevation scour, but this has not been studied. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.	Studies in other river systems have found spring floods to be beneficial to riparian plants. Limited research in Grand Canyon suggests that some limited recruitment takes place after flooding.	While this is a popular measure of ecosystem health, it can be quite variable and difficult to tie to specific ecological goals. It is easy to calculate measures of richness based on our current sampling protocol, but minor to medium fluctuations in richness need to be evaluated cautiously. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.

Species richness	Number of plant species	Trout management flows	Unknown	Unknown	Low	We expect the effect of TMFs on species richness to be a similar to the effect of other types of HFEs on this resource characteristic, with the effect differing depending on whether the TMF occurred in Spring or Fall, but TMFs are different enough from other HFEs to lower confidence: There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		While this is a popular measure of ecosystem health, it can be quite variable and difficult to tie to specific ecological goals. It is easy to calculate measures of richness based on our current sampling protocol, but minor to medium fluctuations in richness need to be evaluated cautiously. Large changes in richness over time would indicate systemic change, and could be investigated further for causes. We recommend continued ground-survey and aerial image monitoring of changes to herbaceous and woody species.
Vegetation structure (vertical layering)	Total vegetation volume or other canopy volume measure	Fall HFEs > 96-hr duration	Unknown	Unknown	Low	We do not know how the changes to the flow regime will alter vegetation structure. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		If this is a priority for stakeholders, funding and staff would have to be increased to accommodate additional data collecting and analysis.
Vegetation structure (vertical layering)	Total vegetation volume or other canopy volume measure	Fall HFEs ≤ 45,000 cfs in October or November	Unknown	Unknown	Low	We do not know how the changes to the flow regime will alter vegetation structure. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		If this is a priority for stakeholders, funding and staff would have to be increased to accommodate additional data collecting and analysis.
Vegetation structure (vertical layering)	Total vegetation volume or other canopy volume measure	Macroinvertebrate production flows	Unknown	Unknown	Low	We do not know how the changes to the flow regime will alter vegetation structure. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		If this is a priority for stakeholders, funding and staff would have to be increased in either the aquatic foodbase or riparian vegetation groups to accommodate additional data collecting and analysis.

Vegetation structure (vertical layering)	Total vegetation volume or other canopy volume measure	Proactive Spring HFEs ≤ 45,000 cfs in April, May, or June	Unknown	Unknown	Low	We do not know how the changes to the flow regime will alter vegetation structure. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		If this is a priority for stakeholders, funding and staff would have to be increased to accommodate additional data collecting and analysis.
Vegetation structure (vertical layering)	Total vegetation volume or other canopy volume measure	Riparian vegetation restoration	Strong	Unknown	Medium	Response of vegetation structure to restoration efforts is expected to be similar to that of other riparian vegetation characteristics: Vegetation at restoration sites is controlled by resource management decisions or their absence. Species composition will likely shift from that established during restoration work as species mature and succession unfolds, with desired vertical structure therefore also likely to shift, whether deliberately managed or not. How this will affect vertical structure is unknown, since it will depend on restoration decisions made at each restoration site.		Develop a science-based vegetation management (e.g., restoration, rehabilitation, or other active management) plan which targets species that would increase structural complexity. Allocate time and money based on goals to track success.
Vegetation structure (vertical layering)	Total vegetation volume or other canopy volume measure	Spring HFEs ≤ 45,000 cfs in March or April	Unknown	Unknown	Low	We do not know how the changes to the flow regime will alter vegetation structure. There was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		If this is a priority for stakeholders, funding and staff would have to be increased to accommodate additional data collecting and analysis.
Vegetation structure (vertical layering)	Total vegetation volume or other canopy volume measure	Trout management flows	Unknown	Unknown	Low	We do not know how any experiment changes to the flow regime will alter vegetation structure, or whether TMF effects will differ depending on whether a TMF occurs in Spring or Fall. There also was some thought that none of the LTEMP experimental flow types will affect vegetation, but this was not a general consensus. There is a general consensus that none of the flow scenarios will reduce the amount of woody vegetation, but how these flows affect the proportions of species (native vs. non-native, increase or decrease particular species of interest, simplify or increase complexity of structure or composition) is not clear.		If this is a priority for stakeholders, funding and staff would have to be increased to accommodate additional data collecting and analysis.