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| **Storytelling**  **Element** | **Description** | **Story #1** |  |
| Theme | The general thematic category of the visual story, based on Vujaković’s (2014) survey of map-based visual stories themes. | A. Environment and Science: 8. Environmental problems/impacts |
| Topic | The specific geographic phenomenon or process covered in the visual story.? | Impact of pollinators on agricultural production |
| Title (panel 1) | A condensed, engaging headline for the visual story. | California Bee-Ware: A cry for pollinator patches |
| Summary | A brief introduction to the visual story following a three-act narrative structure. | ***Purpose:*** *This story investigates the pollinator crisis by examining California agriculture.* ***Problem:*** *California agriculture has destroyed acres of natural ecosystems which support pollinators and other vital organisms.* ***Resolution:*** *The incorporation of natural patches of land and a decreased use of pesticides can help pollinators.* |
| **Act1: Set-up** | | |
| **Setting** | | |
| \*Space | Where the story takes place. | California |
| \*Time | When the story occurred. | 2001-2010 |
| **Characters** | | |
| \*Protagonist  (accented) | The main character in the story. | California Nature: A lush state which has been degraded due to intensive farming |
| \*Antagonist  (accented) | The character in opposition to the protagonist | Agribusiness: Large, industrial farms practicing unsustainable agriculture |
| **The hook (Panel 1)** | | |
| \*The hook | An exciting scene early in the script that captures the audience’s interest and encourages them to continue reading. | From 2001 to 2011, California lost 1,261.73 km 2 of natural bee habitats (Clarke, 2016). Urbanization and pesticide use are accelerating at an unprecedented rate while destroying natural habitats (Albers, 2009). The total loss of habitat in California will likely total 63,000 km 2 which is around ⅛ the total  area of the state. (Lonsdorf et al., 2016). |
| **Context** | | |
| Fact 1 (Panel 2) | Contextual information readers need to know before introducing the problem. | **Title**: Why care about California pollinators? **Fact:** The state of California in the United States is the largest almond producer in the world,  contributing more than 80% of global almond production (Almond Board of California, 2016), and generating more than 100 thousand jobs in California (Klein, A. et al, 2012). **Fact 2:** California is the most productive agricultural state as it produces over 1/3 of American vegetables and 2/3 of American fruits and nuts (CDFA, 2018). In order to produce this much, the farmers rely on three UNSUSTAINABLE components: artificial pollination, monocultures, and pesticides ( Verma, M. K. , 2014 ) .  **Title:** What is the big deal about artificial pollination, pesticides, and monocultures?  There are not enough wild beehives anymore to pollinate all the almond trees, nowadays almond farmers rent privately owned beehives from “bee farmers”. Almond farmers in California need so many bees to pollinate their almond flowers nowadays that they have to import half of USA’s managed honey bee hives every year (Sumner & Boriss, 2006). At the same time these almond farmers use a lot of pesticides to which key pollinators (i.e. bees) are extremely sensitive. The pesticides also have effects on other ecosystem services like water regulation, soil fertility and biodiversity. Furthermore, in combination with other factors such as climate change and loss of habitat, a great loss of bees over the last two decades has occurred. Monocultures, which are areas of agriculture consisting of only one main cash crop and no others, dominate California agriculture. Monocultures desecrate biodiversity and lush ecosystems. What does the boom in bee farming, pesticides, and habitat destruction mean for the sustainability and production of California’s agriculture… |

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| Fact 2 (Panel 3) | Contextual information readers need to know before introducing the problem | **Title:** Why do natural pollinators matter? **Fact:** Without proper pollination, agricultural yields will suffer. Moreover, human contrived pollinators such as bee farms are expensive. One of the largest costs of California farmers comes from the purchasing of artificial bees. |
| **Act 2: Conflict** | |  |
| **Catalyst (Panel 4)** | |  |
| Problem | The key issue driving the story, resolved in Act 3. | **Title: Colony Collapse Disorder Reduces almost half all bees**  Fact: Bee population has declined 40% in the past decades (Berkley). Colony Collapse Disorder explains the sudden drop as “worker bees’ abandon otherwise healthy hives, leaving a helpless queen, nurse bees, and baby bees to die without access to nectar and pollen.” (Berkley). The two greatest contributors to this phenomenon include insecticide use and habitat loss/fragmentation (Greenpeace). |
| **Tension (Panel 5)** | |  |
| Tension | The impact of the problem on the protagonist versus the antagonist. | **Title:** Rising costs of agriculture  Almond producers in California alone need the most pollinators compared to any other crop in the US (UCOP). Due to the extensive use of insecticides and the conversion of natural areas to cropland, native bees have fallen drastically. Consequently, the demand for bee farming has skyrocketed in California. Moreover, the cost of pollination has tripled from 2000 to 2010 (UCOP). |
| **Plot Points 1 (Panel 6)** | |  |
| Plot Point 1  (Cause) | One in a sequence of events motivated by the problem that impacts the characters. | **Title:** Since 2010, the bee population loss has dropped from 40% to 50% of its original population. As a result, more than two-thirds of America’s honeybees are mobilized for pollinating almond trees, and most come from out-of-state apiaries (NYT). Three species of bees have went extinct in America with one other bee being listed on the endangered species act (NYT). |
| **Act 3: Resolution** | |  |
| **Climax (Panel 7)** | |  |
| Plot Point 2  (effect) | One in a sequence of events motivated by the problem that impacts the characters. | The population of non-native bees has surpassed that of natives which further exacerbates the problem ( Royal Society) |
| **Resolution (Panel 8)** | |  |

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| Resolution (Panel  8) | The solution (or solutions) to the key problem and tension. | **Natural strips**  The demand for natural strips has risen in the past decade due to the public and governments feeling responsible to compensate for negative impacts of farming (Harris et al. 2014). Although no standard definition of ‘natural strips’ exists, most universities and organizations define natural strips as a small patch of minimally managed land ranging from a prairie to a semi-forested area (Isaacs, 2011) (Burkle etal., 2017). These patches support pollinators as well as  native organisms that fight pests (Isaacs, 2011). The natural vegetation strips improves the surrounding area biodiversity as much as four times a managed area (Harris et al. 2014). These strips have a number of other benefits including the following: climate change resilience, improved water quality, generation of rural jobs, flood mitigation, decreased greenhouse gases, and habitat creation (Harris et al. 2014). Many studies including the research of Klein et al. (2012), show that farms which are surrounded by semi-natural are visited more by wild bee species. Overall, these natural strips will combat the negative effects of monocultures  **Pesticides**  A class of insecticides that has been particularly thought to be a relevant cause of colony collapse disorder (CCD) in bee populations is the Neonicotinoids  (Dana, 2016; Grossman, 2013). Therefore, the reduction of these insecticides must be carried out. Some ways to reduce pesticides are using fungus, bacteria or fumigants to reduce pests (Epstein, 2003), planting plants that are more attractive to insects around the crops, or by genetically modifying plants so that they are resistant against pests (Zhang et al., 2004). But, both researches state that in order to reduce pesticides the Californian government first has to make a  legislation that states that farmers must reduce pesticides, or farmers will continue with business as usual. |
| **Denouement (Panel 9)** | | |
| Cliffhanger | The dramatic ending, leaving open strands for audience to ponder. | **Title:** Although this story focuses on California and bees, the role of other pollinators and bees across the world cannot be undermined. Pitch for getting involved and some resources? |